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Part 1.

Volume 1. Mineral Resources
2. Mineral Resources

Part 2.

Volume 1. Agricultural Resources
2. Livestock, Hide Resources, Aquatic Resources

Part 3.

Volume 1. Forest Resources
2. Forest Resources, Hydro-electricity and Salt Industry

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p/s translate as indicated

KOBUTSU SHIGEN (Mineral Resources), Vol 1, Part 1, FUTSUIN SHIGEN CHOSANDAN HOKOKU. WDC No 263477.

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KOBUTSU SHIGEN (Mineral Resources), Vol 2, Part 1, FUTSUIN SHIGEN CHOSADAN HOKOKU. WDC No 246335.

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positive modernization of business or any growth of industry. Thus, these enterprises are very much retarded.

To examine these facts, let us show the condition of imports and exports in 1937 (published by the Pacific Association (Taiheiyo Kyokai) from French Indo-China):

	% of total exports	% of total imports
Foodstuff	63.1	8.3
Raw Materials	24.6	3.1
Manufactured Goods	2.6	63.4
Other	9.7	25.2
TOTALS	100.0	100.0

From these figures, showing exports of manufactured goods at 2.6% as against imports of 63.4%, it is very obvious that French Indo-China's industrial development is at a very low level and that this is a low-ranking agricultural area. Thus, this trend by which the coal-mining industry - a basic industry - monopolizes the coal fields, whose benefits could be quite broad, with colonial investments of capital from the French motherland is quite strong.

The administrative authority over the mining industry of French Indo-China, heretofore resting in the hands of the President of the French Republic, was transferred on March 31, 1935, to the French Government-General by Presidential decree at the same time that the current Mining Ordinance was enacted.

The Mines Section comes under the office of the Inspector General of Mines and Industry (l'Inspection Generale des Mines et de l'Industrie). The supervision of the Inspector General's office, established by presidential decree on December 27, 1938, was begun on August 16, 1939, again by presidential decree:

1. Article on Ore Mines and Related Industries
2. Article on Hydrocarbons
3. Explosives

4. Article on Chemical Industries and Activated Carbon
5. Steam Engines
6. Labor Administration in Ore and Coal Mines under the Jurisdiction of the Office of the Inspector General for Labor

Before the outbreak of the present war, the office of the Inspector General was re-organized into the Offices of Industrial Production and Subsidies. The organizational structure is as follows:

1. Office of the Inspector General
2. Military Materiel Industries Section (projected)
3. Geological Section
4. Mines Section

The organization of the Geological and Mines Sections above is as follows:

Geological Section

Geological Section Chief 1

Technical Assistant for Labor Supervision . . . 1

Mines Section

Mines Section Chief (Technician in charge), concurrently Supervisor of Labor 1

Mining Technicians 1

Mining Assistant (Eastern Hanoi Sub-chief) - controller of Explosives and Superintendent of Ore Sales. . 1

Regional branch offices

Saigon Sub-station : Station Chief - Mining Technician 1

Haiphong Sub-station : Station Chief - Mining Technician and Labor Superintendent 1

The main provisions of the current mining-industry law recognize and protect the prior rights of the discoverers of minerals. And, through a simple procedure based on a first-come first-serve system grants the prospecting rights (Articles 14, 16 and 17); but by Article 8 ownership rights in the mining areas and extraction rights are limited to French citizens and Indo-Chinese natives, totally barring any outsiders. Thus,

Article 8

"Without regard to nationality, any individual or company may obtain one or more prospecting rights. However, those having ownership rights in the mining area and those having extraction rights must be French citizens, French nationals, or those under French protection.

"Companies organized to prospect for minerals or to extract minerals, or companies carrying out both prospecting and extracting must be organized according to French law; thus these companies must be owned in France or in French-ruled colonial areas.

"In stock companies three-fourths of the members of the board od directors (Conseil de Surveillance) must be French citizens, French nationals, or those under French protection.

"In anonymous associations the board of administration (Conseil d'Administration) must have a membership made up three-fourths of French citizens, French nationals, or those under French protection."

Important prospecting and extracting rights are also protected in order of priority by Article 8 so that individual participation in French Indo-Chinese mining enterprises by foreigners is totally excluded. Having a company's organization established by a French corporation is the only way to participate. And, foreigners must be satisfied with holding no more than one-fourth of the executive positions. Besides, other than the Hon Gay, Dong Trieu and Along - Dong Dang coal-mining companies which are managed by Frenchmen, there are just the small Neptune and Cha-cha mines managed by Annamese. The French Indo-Chinese coal-mining industry in general has been promoted by French capital and French technology.

However, the Second World War has induced the decline of the influence of the French homeland, and at the same time the independent development of French Indo-China's economy. The development of the

TABLE OF COAL EXTRACTED BY YEAR FROM PITS OF HONGAY MINES
UNIT: 1000 TONS

AREA YEAR	1931	1932	1933	1934	1935	1936	1937	1938	1939	1940
HALAM	175.4	158.1	127.6	95.0	75.0	265.4	314.0	363.1	479.7	454.0
HATOU	150.0	163.4	116.0	132.0	116.0	--	--	--	--	--
CAMPHA	390.4	264.8	277.6	319.0	399.0	478.0	591.0	532.0	596.6	571.3
RAYMOND FERRANT	133.1	106.2	--	--	--	--	--	--	--	--
PORT COURTLET & NAGATNA	150.5	132.5	89.0	62.0	32.0	74.5	113.7	143.7	141.8	139.1
MOND DZDONG	247.6	291.5	304.8	312.0	335.0	489.4	463.3	434.9	394.2	366.0
TOTALS	1,147.0	1,116.5	910.0	920.0	957.0	1,307.3	1,482.1	1,473.7	1,612.3	1,530.4

COMPARATIVE TABLE OF COAL MINED FROM PITS & OPEN CUTS AT HONGAY MINES
UNIT: 1000 TONS

COAL MINE NAME	FROM OPEN CUTS			FROM PITS		
	1938	1939	1940	1938	1939	1940
HATOU, HALAM	119.4	155.8	188.0	243.7	323.0	266.0
CAMPHA	437.5	549.6	571.3	94.1	47.0	--
MONG-DZUONG	96.4	50.9	60.0	338.5	343.2	306.0
PORT COURBET	82.5	75.6	55.5	61.2	65.0	83.6
MAO-KHE	--	--	--	139.9	148.4	164.6
KEBAC	--	--	--	27.0	26.0	20.4
TOTAL	736.2	831.9	874.8	904.4	953.7	840.6
% OF ALL EXTRACTED	48.	46.	51.	52.	54.	49.

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Table of Coal Extracted by Year from Pits of Hongay Mines

Unit: 1000 tons

Area \ Year	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Halam	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Hatou	5[illegible]	[illegible]	115.[illegible]	[illegible]	[illegible]	[illegible]			—	
Campha	[illegible]	[illegible]	[illegible]	319.[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Raymond Ferrant	13[illegible]	[illegible]								-
Port Courbet & Nagatna	15[illegible]	[illegible]	89.0	[illegible]	[illegible]	74.5	[illegible]	14[illegible]	14[illegible].9	[illegible]39.1
Mong Duong	247.6	29[illegible].5	[illegible]	[illegible]	335.[illegible]	[illegible]89.4	463.3	434.9	[illegible]4.2	366.0
Totals	1,147.0	1,136.5	910.0	920.[illegible]	957.[illegible]	1,307.3	1,40[illegible]	1,473.7	1,612.3	1,5[illegible]0.4

Comparative Table of Coal Mined from Pits & Open Cuts at Hongay Mines

Unit: 1000 tons

Coal Mine Name	from Open Cuts			from Pits		
	1938	1939	1940	1938	1939	1940
Halon, Halam	1[illegible]9.4	[illegible]55.8	1[illegible]8.0	[illegible]43.7	323.0	260.0
Campha	437.5	549.6	57[illegible]	94.1	47.0	—
Mong-Duong	[illegible].4	50.[illegible]	[illegible]0.0	[illegible]38.5	343.2	306.0
Port Courbet	32.5	[illegible]5.6	55.5	[illegible]1.2	65.0	83.[illegible]
Mao Khe	--	—	—	[illegible]59.9	148.4	164.6
Kébao		-	-	27.0	26.0	20.4
Total	[illegible]	831.9	[illegible]74.8	[illegible]4.4	953.7	840.[illegible]
% of all Extracted	48	46.	51	52	[illegible]4.	49.

Japan-China Incident and the progress of the Greater East Asia War has quickened the understanding of the French Indo-Chinese authorities of the significance of the Greater East Asia Co-prosperity Sphere and of the fact that the only way is to cooperate with Japan, that they will have to abandon their reliance on the French motherland and work with Japan to re-establish trading channels with Japan and other countries which are occupied by Japan.

Coal Mining Regions and the Square Area of these Regions

Applications for the acquiring of mining rights are accompanied by a fixed tax of 900 francs and are made to the regional Mining Section chief in Tonkin Province or to the provincial chief (Chef de Province) in the case of the other provinces. Mining prospecting rights are granted by the Government General of French Indo-China.

As for the are of the mining regions, by decree of the Government General on November 10, 1941, the maximum size of a mining region was fixed at 900 hectares (about 2,730,000 tsubo) and the minimum at 100 hectares.

The following gives the number of coal mines, their area, and the number of persons with mining rights as of January, 1941:

Coal Mines and the Area of Mines

Type of Coal		Number of Mines	Area (Hectares)
Anthracite & Semi-anthracite		70	97,926.5
Bituminous (coking)		10	5,394
	TOTALS	83 (Sic)	103,320,5
(Established in 1940:			
Anthracite		7	4,787
Bituminous		1	290
	TOTALS	8	5,077

Table of Mines as of January 1, 1941
(Total: 83)

Key:
(E - Being Worked
(N.E - Not yet being Worked
(A.R - Closed Down

(1) ANTHRACITE

Mine	Owner of the Mining Rights	Area (Hectares)	Province	Year Estab.	Condition of Working
Kebao	S.F.C.T.	25,000	Quang-yen	1888	
Hongay	"	20,990	"		
Thoi-Giay	"	364			
Lilerte	"	707	"		
Dong-Thanh	"	549	"		
Tam-Hop	"	172	"		
Qua-Jim	"	601	"		
Mai-Sinh	"	615	"		
Vestä	"	859	"		
Janan	"	900	"		
Monigue	"	342	"		
Royer	"	780	"		
Kysao	M. Kysao	900	"		
Thi-Khang	"	900	"		
Alenxandre Hien	M. Lapiegue	47	"		
	TOTAL	53,726			

(Eastern Region - Port Courbet)

Mine	Owner of the Mining Rights	Area (Hectares)	Province	Year Estab.	Condition of Working
Paul	M. Pham-Monh-Kung	630	"		
Thi-Hue	"	105	"		
Antonin	Alang et Dong-Dang	66	"	1928	E
Clairon	M. Kysao	828	"	1932 "	"
Tambour	"	431	"	"	"
Neptune	M. Ba-Tai	460	"	"	"
	TOTAL	2,520			

(Western Region - Port Courbet)

Mine	Owner of the Mining Rights	Area (Hectares)	Province	Year Estab.	Condition of Working
Paul	M. Lapicgue	784	"		
Lucesse	"	210	"		
Marguerise	"	39	"		
Eclantine	"	196	"		
Chau-Hai	"	336	"		
Marcelle	Pannier Co.	360	"	1911	E
Marcellin	"	115	"	1921	E
Jeanette ~~Antoine~~	Mining and Shipping Co,	360	"		
Antoine	M. Seguy	802.5	"		
Cecile	M. Kysao	284	"		
	TOTAL	8,486.5			

(Alonget Dong Dang Yen-Lap Region)

Mine	Owner of the Mining Rights	Area (Hectares)	Province	Year Estab.	Condition of Working
Francis	Alonget Dong-Dang	374	"	1907	
Hien	"	50	"	1911	R
Lotus	"	47	"		
Moussan	"	48	"	1927	R
Emile	M.Nguyen-Man-Luong	408	"		
Renée ~~Blance~~	Mining and Shipping Co.	880	"		
Blance	"	2,400	"		
Esperance	M.Hoang-Ngo-Bac	521	"		
Van-nho	"	282	"		
Tot-Lam	M. Tran-Dinh-Duang	616	"		
	TOTAL	5,626			

Uong-bi, Dong Trieu Region

Mines	Owner of the Mining Rights	Area (Hectares)	Province	Year Estab.	Condition of Working
Fabien	M. Bach-Thai-Buoi	724	Quang-yen & Haiduang	1915	A.R
Alexandre	"	1,200	"	1915	E
Comet	"	192	Quang-yen		
Francois	M.Cas-Dac-Thuy	30	"		
Printemps	M.Pham-Niu-Bang	419	"		
Saladin	S.C.D.T.	1,860	Haiduong	1900	N. E
Espoir	"	2,400	Haiduong & Quang-yen	1905	E
Francois	"	2,400	"	1908	A. R
Clotilde-Louise	"	2,400	Quang-yen	1894	E
Louisette	Indo-China Coal & Metals Mining	720	Thai-Nguyen	1913	N E
Coloung	"	800	"	1914	
Toling	"	800	"		
Allert (1)	M.Boy Landry	320	"		N E
Henriette	Mme Guita	220	"		N E
Dong-Giao	M. Aviat	196	Niuh-Binh	1901	A E
Alice	Tuyen-Quang Coal	248	Tuyen-Quang	1921	E
Yvonne	"	900	"	1922	N E
Henri	Tonkin Wolfram & Tin Company	900	Cao-Bang		
Armand Dominique		290	Laugson		A E
	TOTAL	10,324			

Company Name (or Individual)	No. of Mining Areas	Area (Hectares)
S. F. C. T.	12	54,281
S. C. D. T.	5	17,875
Alonget Dong-Dang	5	685
M. Seguy	5	2,515.5
M. Kysao	6	3,343
M. Lapicque	6	1,612
Indo-China Coal & Metals Mining Co.	5	3,912
M. Bach-Thai-Buo	2	1,924
M. Ba-Tai	1	460
Others	37	16,813
TOTALS	83	103,320.5

Finally, a comparison with metallic-ore mines:

Material	No. of Mining Areas		Area (Hectares)	
Anthracite	73	28.4%	97,927	50.5%
Bituminous Coal	10		5,394	
Tungsten	48		16,203	
Tin	68		32,484	
Iron and Manganese	20		10,145	
Apatite (Phosphorus ore)	19		10,635	
Gold	18		12,176	
Chrome	8		4,383	
Others	28		16,522	
TOTALS	292		205,689	

Note: % given = percentage of total

Taxes Collected on Mining

The average amount collected by the Mining Tax Collection Office is as follows for the twofdifferent types:

Kind	1938	1939	1940
1st Type	13,364	13,973	15,524 piasters
2nd Type	5,955.4	5,222.6	6,704.3

For reference, we may record a summary of taxes collected from French Indo-China's coal mines -

The three kinds of taxes are the mine tax, mine production tax and profit tax:

1. Mine taxes

0.9 piasters per year per hectare or less from the year of approval of establishing the mine.

2. Mine production taxes

Computed independently for each of the two types, according to the annual average market value of the mine product of the previous year, delivered F.O.B. portside or F.O.R. at the railhead (According to the two types shown in the table).

The value of the tax is 3% of the standard value. Or, if the value rises above 3% of the standard value, the tax is 0.025% of the first 20% over the standard value, 0.05% of the next 20%; and the rest (i.e., all above 40%) is assessed at 0.4%. On the whole amount there is a limit of 60%.

For example:

If the average market price for the previous year was 14.3 piasters, the percentage of the value which exceeds the standard price of 9.65 piasters is $\frac{14.30 - 9.65}{9.65} = 48.2\%$.

This is taxed as follows:

On the standard (average)	3.00%
On the first 20% - 0.025% X 20, or	0.05%
On the next 20% - 0.05% X 20, or	0.10%
On the remaining 8.2% 0.1% X 8.2, or	0.82%
TOTAL	3.97%

So, 3.97% of 14.3 piasters is taxed - 0.565 piasters.

3. Profit taxes

Extractors are taxed by 10% of the previous year's net profit derived from extracting operations. However, the tax is on the standard derived by subtracting 3,600 piasters from the net profit.

Table of the Kinds of TTaxes on Mine Products and the Standard Prices

	Taxable Mine Products	Comparative Annual Average Prices	Standard Price
1st Type	Anthracite Bituminous Brown coal, briquettes; other processed products except unscreened coal.	Average market price of coal from Hongay mines, at Hongay & Can Hua ports; and Dong Trieu coal at Le Dong port; Mao Cay pit coal at Le Dong & Mao Cay ports - all graded coal of more than 30mm and FOB.	9.65 piasters
2nd Type	Unscreened anthracite coal. Powder anthracite under 6mm with impurities not removed & with under 12% volatile elements; excludes ash and water part. High-grade brown bituminous coal, ash & water parts removed, more than 40% volatile elements.	Average FOB market price of anthracite containing less than 15% ash and under 10mm in size; delivered from the Hongay mines to Hongay or Can Hua ports, or from Dong Trieu mines to Le Dong, or from Mao Cay pit to Le Dong or Mao Cay ports.	4.65

Average Total Price for Concentrated and Screened Coal Delivered to our Ports

Year	Average Price (in Yen) for conc. & screened coal
1931	11.60
1932	20.70
1933	13.00
1934	13.10
1935	13.20
1936	13.50
1937	15.60
1938	20.00
1939	22.00
1940	23.00

National Taxes on Coal Products

(Average of Rough Totals)

Type of Tax		Way Computed	1935	1936	1937	1938	1939	1940
Tax Computed by %	(Fuel Ores	Computed from totals	78898	98154	122969	714370	874202	1062544
	(Other Ores		39424	45516	281277	369963	435969	486956
	(TOTALS		118322	143670	404246	1083333	1311171	1549500
Land Tax Collected According to Land Value		Land Area Computation	142800	109404	110372	104931	110695	200252
Tax on Contracts (Cay Bao Mines)		Computed for Tonkin Area	1295	1480	1040	1350	896	922
Tax Fixed by Mine Depth		Computed by Region	9875	9950	14025	16525	10400	12525
Mine Tax	(Tax Set by (Application	Computed from totals	200	350	1200	1800	3800	3100
	(Tax Set by (Inspection		550	650	2150	850	2400	2100
GRAND TOTALS			273042	265504	533533	1208789	1439362	1768399

Note: Tax computed by percentage is a tax which is liquidated every other year with the Mines Section as a tax on production.

Finally, the land tax by province (Unit: piasters):

	1939	1940
Tonkin	77,097	147,455
Annam	20,097	30,066
Cambodia	1,691	3,211
Laos	11,972	19,520
	110,696	200,252

For tin and tungsten the taxation rate reaches the maximum limits, but coal is taxed only 6% for the 1st Type (4.98% in the previous year) and 4.92% for the 2nd Type (3.67% in the previous year).

Though 1940 was a year of general decrease in production as compared to 1930, the increase in the tax computed by percentage is due to the rise in prices.

Under most recent conditions the supply and demand relationships of the past have broken down. Together with the shortage of freight space, the rapid increase in coal stock-piles also worries the producers so that the management is not at all like it appeared to be in former times. They are fearful of the effect which will result from our country's completion of the development of the North China anthracite. They are doing their utmost to induce domestic consumption of their product. By a decree of the Government-General on March 13, 1942, a standard amount of production was fixed so that as a result a controlled management of production and marketting has been brought into the picture.

Decree of the Government-General on Fuel-Ore Production Plan - (Issued on March 13, 1942)

1. The extraction of fuel ores in the three provinces of Quang-yen, Haiduong and Bac-giang must follow the production plan established by decision of the Government-General each year.

2. The percentage of producers for the domestic market to producers for the export market will be determined by consideration of the past production peak for each mine, the special relationships between the extractors, and the market for their products. The market, as a general rule, will be reserved for those mines presently being worked; mines which cease production during the next six months and mines which started operations more than six months ago but which are still not up to full production will not receive permission to market their product.

3. Contracts for domestic marketting or for exporting are required to obtain a prior visé from the Chief, Haiphong Mining Industries Branch Office. This same Branch Office chief will inspect these contracts to verify their adherence to the consitions of the program and to other regulations.

4. The customs houses, tax offices, the native constabulary of the Chi-Linh regional office and the officials of the Mining Industries Office and diplomatic ministers shall, in order to set forth clearly the details of markets and transportation, have the right to rule between the customs houses and the Mining Industries Inspector General and the chiefs of the tax offices on the basis of the controlling regulations.

5. The carrying out of the duties acoruing to the Mining Industries Office and its branch offices through the above articles is the responsibility of the Mining Section of Indo-China. The said office shall investigate the allocation of production in ton units, or the allocations resulting from modifications in the production plans. Also, this same office will present proposals to assist in the making of such modifications.

6. Responsibility for carrying the said Ordinance of the Government General into effect is born by the Director General of the Government General, the Directorate General of Tonkin Province, the Director of the Economics Office, the Customs Houses, the Directors of the Tax Offices, the Inpsectors General for Mining Industries and other related officials.

Production Standards for Fuel-Ore Mines
(Unit: tons)

Table A	Domestic Market		Foreign Market
	1st Grade Products	2nd Grade Prod.	
Tonkin Coal Mining Co.	407,000	153,000	120,000
Dong-Trieu Company	70,000	60,000	70,000
Dong-Dang Co.	3,000	12,000	5,000
Cha-cha Mine	10,000	2,500	7,500
Tambour Mine	10,000	2,500	7,500
Neptune Mine	-	-	No fixed Amount
TOTALS	500,000	230,000	210,000

Table B Maxima for Monopolies in Domestic Indigenous-Demand Market

M. Beauregard	15,000 tons
Bao-Ha Mines	10,000
Bieho Mines	8,000
Co-Kenh Mines	3,000
TOTAL	36,000 tons

GRAND TOTAL: 976,000 tons

Section 2 Geology and the Quality of the Coal

The coal fields of French Indo-China can be divided into the following different fields:

(1) Hongay coal fields
   a. Kebao region
   b. Cam-pha - Mong-dzuang region
   c. Hatou - Halam region
   d. Nagotna Ngahai region
(2) Dong-Trieu coal fields
   a. Dong-Dang region
   b. Yen-lap - Mao-Khe region
   c. Clotilde-Louise region
(3) Phan-me coal fields
(4) Tuyen-quang coal fields
(5) Phu-nho-quang coal fields
(6) Tourane coal fields

1. In the Hongay coal fields the middel and upper coal measures are worked. This is true in the Cam-pha and Hatou - Halam regions' coal layers and in the upper coal measures of Mong Dzuang, Ngahai and Nagotna.

2. In the Dong-Dang region of the Dong-Trieu coal fields the upper coal measures are worked, and the Yen-lap and Mao-Khe regions work the lower coal measures. In the Clotilde-Louise area the middle and upper parts of the coal measures are worked. These groups of coal seams are believed to run westward and to continue for more than 20 kilometers.

As the above coal fields are related to the Rhetgue layer of the Mesozoic deposits, the coal quality is all anthracite and is pretty much uniform. The upper coal measures number many tens of seams and are excellent quality coal, mostly one to three meters thick. The middle coal seams are made up of the thick main seam and just two or three seams tangential to it. The lower coal measures are partly coal seams of about seven meters thickness, but in general are coal layers of about a meter in thinkness, with large amounts of impurities. They have very limited possibilities. Thus, the middle and upper coal measures are representative of French Indo-Chinese anthracite.

3. The Phan-me coal fields, just as with the previous two fields, are made up of coal seams belonging to the Mesozoic layers. But, in the Phe Xuan region (?) the coal seams are very narrow and contain many faults along the strike of the seams. There are only two places where the seam continues for as much as 400 meters. The coal here is the only strong coking coal in French Indo-China. However, since the amount of the reserves is no more than several hundred thousand tons, it is felt that its possibilities for the future are extremely poor.

4. The Tuyen-quang coal fields are coal deposits belonging to the Tertiary strata and are in direct contact with Palaeozoic strata coal because of faults. Their area of reserves follows along a strike which runs along a 1,500 meter incline for about 200 meters. The coal seams are quite windy and range in thickness from two to seven meters. The coal contains many intrusions of slate and when it is caked with low-grade bituminous coal can be used as furnace coal. Thus, for local supply it is an interesting coal. However, the reserves of this coal probably do not exceed a million and three or four hundred thousand tons.

5. The Phu-nho-quang coal field and the Tourane coal field are both very small-scale operations, and neither has any future possibilities.

In summary, the coal of French Indo-China - in a word - is represented by the anthracite coal of the Tonkin region. And, as far as use in railroads, industries and bunkers goes, there is but a very small amount of the proper kinds of coal, so that the development of future industries will have to await studies on methods for using anthracite and also will have to await the import of bituminous coal from other areas.

Coal Quality

The coal of French Indo-China is mostly anthracite. Bituminous coal is found only at Phan-me and Tuyen-quang. The first locality produces strong coking coal, the latter, weak coking coal. Although it is used for steam boilers and part of it can be used to make coke, the amount of reserves is small; and the slight prospect for increasing production is to be regretted.

The anthracite is of the best quality to be found in East Asia. And, being unlimited in quantity, it has very promising possibilities for the future. Though it does not come up to the Shensi Province anthracite of North China in quantity, quality-wise it is superior to that of Shensi.

~~Even~~ Among the anthracites of French Indo-China, that of the Hongay region has been demonstrated by analysis to contain but a small percentage of water and ash, while the percentage of volatile elements is comparatively great, reaching 7% (sic). In contrast, the anthracite of the Dong-Trieu region has a high water content - more than 4%; and compared to the anthracite of the Hongay region, its ash content, too, is somewhat high, while the volatile elements come to less than 4%. Yet, the coal of both Hongay and Dong-Trieu has a fixed carbon content of about 90%. Because of its large amount of volatile elements, Hongay coal burns easily. Also, as for hardness, the coal of the Dong-Trieu region is much harder. Consequently, it has a high percentage of lump coal, so that as a basic resource for various industrial uses, each has its advantages and disadvantages. Yet, as far as anthracite prices are concerned, both coals are about the same. Next, the anthracite of the Bicho ~~(Translit.)~~ and Mao-Khe regions, because of its high ash content, is far inferior to that of the previous two regions.

Finally, for the future, the anthracite coal of French Indo-China will be a very useful kind of coal for mixing in the manufacture of coke, as well as in the carbide industry; and it will of course be a very important natural resource of the East Asia Co-prosperity Sphere.

Section 3 Conditions of Production

Coal holds a central position among all the French Indo-Chinese mining-industry products and is of fine quality - even the best in the world. But, in terms of world power the value of this product is fairly insignificant - equalling no more than 1/20th of all the coal produced in our country in 1940. Now, coal production in French Indo-China during the past 50 years was as follows:

Unit: 1000 tons

Classification of coal	1890-99	1900-09	1910-19	1920-29	1930-39	Total
Anthracite	1,438.9	2,806.3	5,476.4	12,400.4	19,033.4	41,155.4
Semi-anthracite	-	159.6	125.4	192.7	17.9	495.6
Bituminous coal (used as coke)	-	-	67.1	286.2	253.3	606.6
Brown (soft)	-	96.5	84.2	100.4	240.1	521.2
TOTALS	1,438.9	3,062.4	5,753.1	12,979.7	19544.7	42,778.8

After management of coal mining by the French began in French Indo-China, the production peaks have moved steadily upward. The amount of the extracted coal by class of coal during the past ten years was as follows (Unit: 1000 tons):

Year	Anthracite (3-10% volatile comp.)	Others (15-45% volatile comp.)	Total
1931	1,673	53	1,726
1932	1,665	49	1,714
1933	1,542	49	1,591
1934	1,555	37	1,592
1935	1,740	34	1,774
1936	2,151	35	2,186
1937	2,264	43	2,307
1938	2,280	55	2,335
1939	2,561	54	2,615
1940	2,443	58	2,501

Looking at the picture this delineates, one can see the decrease in amounts produced in the period of the world depression extending from 1931 to 1933. But, the trend from 1935 on was for increases. However, due to the outbreak of the Japan-China Incident and the Second European disturbance, the markets became restricted, French technicians were drafted and laborers were requisitioned so that no strengthening of productive capacities could be comtemplated. After the Greater East Asia War broke out, the sea lanes about Europe and America were cut so that even the sea transport facilities of the neutral countries could not be counted on. In view of the lamentable insufficiency of our own ships, the limits on the markets for French Indo-Chinese coal - with only our Japan remaining as an external market - unfortunately cannot be overcome.

Table of Coal Produced - by Company & Mine (Unit: tons)

(See Appended Sheet #1)

Table of Extracted Coal - by Type of Coal (Unit: tons)

(See Appended Sheet #1)

The method of extraction in the initial period of the development of the French Indo-China coal fields was to dig the exposed heads of the thick seams. But, after carrying on open-air digging for a time, the conditions gradually worsened; and they switched to digging in pits. The following table shows the figures for open-pit extraction of coal during the last ten years (Unit 1000 tons):

Method of Digging	1931	1932	1933	1934	1935	1936	1937	1938	1939	1940
Open-air	470	460	450	445	510	627	708	736	832	875
Pit	1257	1254	1141	1147	1265	1559	1600	1599	1783	1625
TOTAL	1727	1714	1591	1592	1775	2186	2308	2335	2615	2600
% Open-air	27.2	26.8	28.2	27.9	28.8	28.8	30.6	31.6	31.8	34.8
% Pit	72.8	73.2	71.8	72.1	71.2	71.2	69.4	68.4	68.2	65.2

Appended Sheet #1-a

Table of Coal Produced - by Company & Mine

(1) Anthracite	1931 (1)	1932 (2)	1933	1934	1935	1936	1937	1938	1939 (3)	1940 (4)
S. F. C. T.	1,397,000	1,304,000	1,078,000	1,015,000	1,059,712	1,465,547	1,637,826	1,644,288	1,787,095	1,715,392
S. C. D. T.	162,000	220,000	320,000	373,000	502,808	538,350	483,656	458,269	562,605	484,786
Along et Dong-Dang	52,000	50,000	42,000	42,000	39,854	41,260	41,373	54,633	64,062	69,435
Tambour	2,000	4,000	7,000	16,000	50,329	29,000	20,642	34,064	26,464	52,563
Neptune	-	3,000	5,000	14,000	19,999	20,000	20,000	18,610	34,636	25,954
Cha-cha	40,000	57,000	21,000	12,000	20,229	17,012	31,356	48,833	45,761	40,600
Co-Kenh	16,000	14,000	10,000	11,000	15,996	17,823	23,298	11,100	12,867	4,574
Bicho	-	8,000	18,000	26,000	27,819	17,117	3,836	3,506	5,854	8,545
Printemp	-	-	-	-	3,082	4,415	2,018	4,189	10,079	7,119
Esperanae	-	-	-	-	-	130	-	1,730	800	2,000
Emile	-	-	-	-	-	-	-	100	327	480
Marcelle	-	-	-	-	400	-	370	598	40	-40
Van-nho	-	-	-	-	-	-	-	-	150	4,529
Paul	-	-	-	-	-	-	-	-	-	3,669
Song au Dzuong	-	-	-	-	-	-	-	-	-	1,564
Thai Loc	-	-	-	-	-	-	-	-	-	40
Thi-Hue	-	-	-	-	-	-	-	-	-	600
Total Quang-Yen Basin strata anthracite	1,669,000	1,660,000	1,501,000	1,509,000	1,740,228	2,150,654	2,264,378	2,279,920	2,550,740	2,421,855
Phu-Lung-Thuong (Bo-Ha)	-	-	-	-	-	-	-	294	4,529	13,493
Uoc-Le	-	-	-	-	-	-	-	-	-	8
Phuto Richesse	-	-	-	-	-	-	-	-	5,752	7,671
Dong Viet	-	-	-	-	-	-	-	-	-	100
Phong Saly	-	-	-	-	-	-	-	-	4	4
- Others -	4,000	5,000	41,000	46,000	-	-	-	-	-	-
Total	4,000	5,000	41,000	46,000	-	-	-	294	10,285	21,276
Total for Anthracite	1,673,000	1,665,000	1,542,000	1,555,000	1,740,228	2,150,654	2,264,378	2,280,214	2,561,025	2,443,131

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Appended Sheet #1-b

(2) Bituminous	1931	1932	1933	1934	1935	1936	1937	1938	1939	1940
Phan-me	30,000	23,000	24,000	17,000	16,236	18,439	22,722	31,695	33,631	39,675
Tuyen-quang	21,000	25,000	10,000	10,000	17,567	16,977	20,306	23,021	20,155	15,357
Yen-Bay	-	-	-	-	-	-	-	-	200	2,000
(Name omitted)	-	-	-	-	-	-	-	-	-	134
Other	2,000	1,000	15,000	10,000	-	-	-	-	-	-
Total for Bituminous	53,000	49,000	49,000	37,000	33,842	35,416	43,128	54,716	53,986	57,166
(3) Semi-bituminous coal										
Nongson	-	-	-	-	-	-	-	-	200	279
Surprise (Hoa-Binh)	-	-	-	-	-	-	-	-	-	310
Total	-	-	-	-	-	-	-	-	200	589
GRAND TOTAL ALL COAL	1,726,000	1,714,000	1,591,000	1,592,000	1,774,070	2,186,070	2,307,506	2,334,930	2,615,211	2,500,886

Notes:

(1) Mao-Khe Mine 169,000 tons & Kebao Mine 81,000 tons)
(2) Mao-Khe Mine 105,000 tons & Kebao Mine 84,000 tons) are included.
(3) Hongay Brown coal 26,440 tons)
(4) Same 28,073 tons)

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Appended Sheet #1-c

Table of Extracted Coal - by Type of Coal (Unit : tons)

Coal Type	1931	1932	1933	1934	1935	1936	1937	1938	1939	1940
Anthracite	1,673,000	1,665,000	1,542,000	1,555,000	1,740,228	2,150,654	2,264,378	2,230,214	2,561,025	2,443,131
Breakdown (S.F.C.T. %	83.4	78.5	69.5	65.3	60.9	68.1	72.3	72.1	69.8	70.2
(S.C.D.T. %	9.7	13.2	20.7	24.0	28.9	25.0	21.4	20.1	22.0	19.8
Total	93.1	91.7	90.2	89.3	89.8	93.1	93.7	92.2	91.8	90.0
Bituminous, Soft coal	53,000	49,000	49,000	37,000	33,842	35,416	43,128	54,716	53,986	57,166
Semi-bituminous coal	-	-	-	-	-	-	-	-	200	589
GRAND TOTAL	1,726,000	1,714,000	1,591,000	1,592,000	1,774,070	2,186,070	2,307,506	2,334,930	2,615,211	2,500,886

Note: The breakdown is the percentage of the production of the two big mines against the overall total for anthracite production.

As seen in the table, there has been an increase during the past several years in the percentage of open-air digging. This has been aided by the employment of women and children who replace miners transferring from the Hongay mines, for example, to such jobs as work in military materiel factories. The women and children work in the safe, easy open pits. This, then, explains how the amount of coal extracted is maintained.

Dressing and Screening Coal

Although washing and grading the coal from the best coal seams, and thus from the finest part of the coal, in general should produce a standard grade of extracted coal, the increase in the admixture of impurities, plugs of dirt and sand from the coal seams in pit digging is unavoidable. However, the Hongay and Dong-Trieu mines not only screen and hand-sort their coal in order that it will conform to military specifications for use as coke in chemical industries, but they also have installed water-washing machines, and in other ways are endeavoring to improve the quality. Most of the small mines merely screen the coal.

The following table shows the extracted coal classified by company, distinguishing dressed and unscreened coal (Unit:1000 tons):

Table of Companies, Dressed and Unscreened Coal (Part I)

Name of Mine	1935			1936			1937		
	Dressed	Unscr.	Total	Dressed	Unscr.	Total	Dress	Unscr.	Total
Tonkin	480	580	1060	514	951	1465	558	1080	1638
%	45	55	100	35	65	100	34	66	100
Dong-Trieu	324	179	503	379	159	538	309	175	484
%	64	36	100	70	30	100	64	36	100
Cha-cha	6	14	20	5	12	17	10	21	31
%	30	70	100	30	70	100	32	68	100
Along et Dong-Dang	3	37	40	4	39	43	5	36	41
%	8	92	100	10	90	100	12	88	100
Other anthracite mines	18	104	121	7	83	90	2	69	71
%	14	86	100	8	92	100	3	97	100
Totals	830	914	1714	909	1242	2151	884	1381	2265
%	47	53	100	42	58	100	39	61	100
Bitum. total	7	27	34	5	30	35	16	27	43
%	20	80	100	15	85	100	37	63	100
GRAND TOTAL	834	941	1778	914	1272	2186	900	1403	2308
%	47	53	100	42	53	100	39	61	100

Table of Companies, Dressed and Unscreened Coal (Part II)

Name of Mine	1938 Dressed	1938 Unscr.	1938 Total	1939 Dressed	1939 Unscr.	1939 Total	1940 Dress	1940 Unscr.	1940 Total
Tonkin	627	1014	1641	659	1128	1787	556	1159	1715
%	38	62	100	38	62	100	32	68	100
Dong-Trieu	301	157	458	354	209	563	289	197	485
%	66	34	100	63	37	100	59	41	100
Cha-cha	14	35	49	11	34	45	7	34	41
%	29	71	100	24	76	100	17	83	100
Along et Dong-Dang	5	50	55	5	59	64	4	65	69
%	9	91	100	8	92	100	6	94	100
Other anthracite mines	4	73	77	8	94	102	10	125	135
%	5	95	100	8	92	100	7	93	100
Totals	951	1329	2280	1038	1523	2561	865	1580	2445
%	42	58	100	41	59	100	35	65	100
Bitum. total	14	41	55	12	42	54	10	45	55
%	25	75	100	22	78	100	18	82	100
GRAND TOTAL	965	1370	2335	1050	1565	2615	875	1628	2500
%	41	59	100	40	60	100	35	65	100

Section 4 Condition of Exports & Imports

The policies of the French motherland toward French Indo-China, as already discussed, are of a colonial character toa high degree, so that Indo-China is no more than a reserved market for natural resources for the industries of the homeland. Also, as a monopolized market for the motherland's manufactured goods, it is forced into a subordinate relationship with the homeland and is made to adopt exclusionist policies toward the countries competing with the homeland. For this reason, such raw materials as rice, rubber and coal, which constitute the keys of the Indo-Chinese economy, occupy an overwhelmingly predominant position, while the big profits go to the French homeland. Thus, the domestic market for coal, a basic production material for Indo-Chinese industry, is extremely narrow; and the favorable price of Indo-Chinese coal cannot be manifested domestically. Through its exports, the coal extensively seeks out foreign markets, and finds its cheif markets along the trade channels of the Far East.

1. the Domestic Market

French Indo-China uses its national production of coal partly for export and partly for domestic consumption. The amount of consumption, compared with the amount produced, is 30%-36%. Now, we may show the domestic consumption during the past ten years as follows (Unit: 1000 tons):

	1931	1932	1933	1934	1935	1936	1937	1938	1939	1940
Domestic Consumption	523	495	452	442	503	560	690	744	829	919
Amount Produced	1726	1714	1591	1592	1774	2186	2308	2335	2615	2501
Domestic Consumption as % of total	30.3	28.8	28.4	27.7	28.3	25.6	29.8	31.8	31.7	36.7

Of these amounts, the Hongay and Dong-Trieu mines supplied, as usual, almost all of the anthracite for the domestic market, contributing 90% and 91% respectively in 1939 and 1940. Also, the tendency for an increase in domestic consumption over the years tells of the development of industries and the rise of small-scale subsidiary industries. This shows the interesting fact that in the past French Indo-China has been a country for supplying natural resources.

Finally, as shown in the following table of domestic coal consumption by province, Tonkin province is far ahead of the other protected areas in the development of its chemical industries, with most of French Indo-China's chemical factories, paper-making factories and other factories grouped here, so that this province is in the forefront in modern industrial development.

Table of the Domestic Coal Market (Unit: 1000 tons).

	1939				1940			
	Anthr.	Bitum.	Coke Br.	Total	Anthr.	Bitum.	Coke Br.	Total
Tonkin	560.0	46.1	69.3	676	646.5	56.8	34.0	737.3
Annam	15.1	4.6	19.1	39.0	19.8	6.3	23.7	49.8
Cochin China	69.9	-	44.7	114	96.9	-	35.4	132.3
Briquette Production	149.9	3.7	-	154	115.2	3.0	-	118.2
Mine Consum.	78.0	1.4	20.5	100	90.3	8.5	13.2	112.0
TOTALS	868.9	55.8	153.6	108.3	968.7	74.6	106.3	1149.6

Next, the changes in the distribution of coal in French Indo-China are shown in the following table (Unit: 1000 tons):

Table of Coal Distribution

	1937	1938	1939	1940
Amount Produced	2308.0	2334.5	2615.0	2500
Amount Imported	13.4	13.3	14.9	15.2
Coal Stock	69.9	-	-	29.8
Withdrawn from Stock	-	63.0	49.0	8.1
Added to Stock from Imports	-	-	11.0	-
Total Apparent Consumption	2252.5	2410.8	2690.0	2493.5
Domestic Coal as Coke Briq.	106.9	109.3	153.6	118.2
Imported Coal - Use in Mfctrg.	20.0	16.7	26.0	23.3
TOTALS	126.9	126.0	179.6	141.5
Coal Distribution (Allocation)	2122.6	2285.0	2510.0	2352.0
Stock - Dec. 31	266.7	-	-	-

20,000 to 30,000 tons of bituminous coal had to be imported for processing into briquettes and coke. Although the total consumption of coal in 1940 was 2515.2 thousand tons, the differences in computations result in apparent consumption of 2493.5 thousand tons. Since 141.5 thousand tons of coal are consumed by use in the manufacture of coke briquettes, the net of 2352 thousand tons is allocated as the amount consumed at the mines, the amount of export and the amount of domestic consumption.

The following table shows the allocated coal (Unit: 1000 tons):

	1937	1938	1939	1940
Mine consumption	63.3	71.3	78.0	98.8
Amount of Export	1532.7	1573.0	1718.0	1461.0
Amount Re-exported	526.6	640.0	61.0	89.0
Amount Domestic Consumption			653.0	703.6
TOTALS	2122.6	2285.0	2510.0	2352.0

2. Foreign Markets

In the initial period of the Indo-Chinese coal industry, what with the restrictions on the markets, it was like groping along a path of brambles. Yet, in 1915, during World War I the markets were expanded due to the unprecedented rise in prices but despite the crisis of rising costs for sea freight. However, after 1929 the industry felt the effects of unsettled world conditions and was unable to find markets within the country; it took much painful effort to break through protective tariffs and other great barriers. Even with such favorable factors as fine-quality coal and low wages it was very difficult. And, in 1931 the consumption by local inhabitants had dropped by 20%. From 1931-33 consumption dropped 10% overall. And, exports to Japan were at the unprecedented rate of ¥11.60 per ton until conditions for maintaining the level of exports were finally established. Yet, the precipitous fall of the price of silver in China - the chief importer in the Far East market - resulted in a decrease in that nation's buying power. This had no small effect on the development of French Indo-China's commerce and industry.

After World War I the cost of freight pushed up and up due to the critical shortage in shipping at Shanghai. The cost of freight to France had risen to 21.58 piasters in 1938, 25.0 in 1939 and 50.0 piasters in 1940. And, when the war between the French and Germans began, exports had, in fact, entirely ceased. The American market was in the same shape too. At the end of 1939 the cost of freight to Mexico had reached 42 shillings 6 pence, and thus was obstructing the settlement of payments. French Indo-China gradually became able to consume some of its coal itself, but the overseas markets were being lost.

In contrast, the Far Eastern markets are largely unchanged and are the main customers, consuming 90% of French Indo-China's coal. In 1932 the demand for Indo-Chinese coal, paralleling the development of our heavy industries, became very strong, and from 1935-1937 took

51 - 53% of the total amount exported from French Indo-China. Although the strengthening of the administration of our currency exchange in 1937 led to some decrease, the necessity of increasing the amount of our import has become more and more urgent since the conclusion of the French Indo-China Agreement between our Occupation forces and North and South French Indo-China. Yet, because of the shipping shortage, it is hard to see how this can be done.

The China market is more opportune for them from the regional point of view than is our country; and though their imports could exceed ours, still the collapse in the price of silver in China in the Spring of 1933 was very violent; and the enforcement of protective tariffs had the effect of a very strong blow against that market.

French Indo-China's Coal Exports (Unit: 1000 tons)

Exported to:	1931	1932	1933	1934	1935	1936	1937	1938	1939	1940	1941
Japan	436	345	527	547	756	913	808	672	673	476	515
%	35	30	42	47	51	53	53	49	37	31	39
China	504	503	401	274	218	297	257	410	507	645	238
%	40	44	32	23	15	17	17	30	29	42	18
Hong Kong	188	167	112	95	86	88	112	135	188	106	374
Philippines	5	2	5	17	29	9	16	26	26	28	17
Singapore	6	2	5	7	9	11	20	3	15	10	20
Thailand	8	3	5	7	12	8	14	17	29	29	15
Total for the Orient	1147	1022	1055	947	1110	1326	1227	1263	1438	1297	1179
%	92	89	84	81	74	77	81	92	81	84	89
France Proper	90	117	180	196	252	286	249	193	171	2	0
%	8	10	14	17	17	17	16	14	10	(0)	0
North America	0	0	0	0	61	87	8	25	25	0	-
Other	11	8	16	28	80	21	48	92	147	251 (1)	151 (2)
GRAND TOTAL	1248	1147	1251	1171	1503	1719	1532	1373	1779	1550	1330

Notes: (Statistics for 1935-40 are those of the French Indo-Chinese Government.
(1) includes 24,000 tons exported to Italy.
(2) includes 39,000 tons shipped to Manchukuo and 55,000 tons for ship stoking.

Excerpts from Reports of the French Indo-China Resources Survey Group - Minėral Resources, published by the Southern Area Office, Ministry for Greater East Asia

Part I

Chapter 1

Section 5 Anthracite Imported into Our Country

The first time that French Indo-Chinese anthracite was imported into our country was about 1917. It was but a very small quantity, but after the end of the First European War the demand increased so that imports were seen to reach 800,000 to 900,000 tons, as in 1936-1937.

Although the amount decreased somewhat thereafter because of our nation's exchange controls and the shortage of shipping, the decrease was chiefly in the lower grades of coal. Higher grades of coal, which are useable in chemical industries and other areas, were imported just as before.

The major classes (according to use) of coal imported from French Indo-China before the Incident (war with China) were:

1.	Used in chemical industries	43%
2.	Raw material for coke	21
3.	Others	36

Conditions thereafter caused an increase in the import of that anthracite used as a reducing agent, besides one or two other uses, while low-grade briquette coal, "kitchen" coal, coal for drying, etc., showed a decrease. Thus, the excellent coal of Dong Trieu, etc., may have decreased slightly, but the poorer grades of coal saw definite import decreases. While we cannot give the latest statistics, those at the time of the outbreak of the China Incident were as follows (in percentages):

	Hongay	Dong Trieu	Others	Total
Tokyo-Yokohama area	30	4	12	46
Nagoya area	7	1	3	11
Kobe-Osaka area	8	3	5	16
Wakayama-Matsuyama area	16	9	2	27
TOTALS	61	17	22	100

Record of Imports of French Indo-China Coal

Importer	Kind of Coal	Destination	1937	1938	1939	1940	1941
Mitsui Bussan	Hongay	Japan	500,000	349,000	358,000	241,000	280,000
		Formosa	8,000	5,000	7,000	9,000	7,000
		Manchuria	-	2,500	17,000	29,000	2,000
	Dong Trieu	Manchuria	-	-	-	-	35,000
Iwai Shoten	" "	Japan	250,000	203,000	188,000	140,000	153,000
		Manchuria	-	-	-	-	2,000
East Asia Coal Co. (ex Far East Company)	W. Hongay	Japan	44,000	76,000	58,000	39,000	42,000
Ataka Trading Co.	Tambour	Japan	15,000	17,000	7,000	7,000	8,000
Min-Tok Trade Promotion Company	Dong Trieu	Korea	-	23,000	55,000	24,000	25,000
Azuma Trading Co.	Hongay	Japan	5,000	6,000	13,000	10,000	8,000
TOTALS			842,000	681,000	703,000	499,000	562,000
Breakdown		(Japan	834,000	651,000	624,000	437,000	491,000
		(Formosa	8,000	5,000	7,000	9,000	7,000
		(Korea	-	23,000	55,000	24,000	25,000
		(Manchuria	-	2,500	37,000	29,000	39,000

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Consumption Usage of French Indo-China's Coal Imports

Use	Origin	1937	1938	1939	1940	1941
Coking gas	Japan	172,000	190,000	220,000	165,000	203,000
Carbide	Japan	231,000	195,000	268,000	118,000	136,000
	Formosa	8,000	5,000	7,000	9,000	7,000
Chemical Ind.	Japan	152,000	120,000	125,000	58,000	50,000
	Manchuria	-	2,500	17,000	29,000	39,000
	Korea	-	23,000	55,000	24,000	25,000
Iron & Steel Manufacture	Japan	6,500	5,000	7,000	5,000	12,000
Manufacture of Ships & Machns	Japan	2,000	2,000	3,000	6,000	8,000
Light metallic electrodes	Japan	78,000	31,000	22,000	9,000	15,000
Pottery	Japan	500	2,000	4,000	2,000	4,000
Minor uses, etc.	Japan	8,000	6,000	10,000	10,000	8,000
Coal briquette	Japan	184,000	100,000	65,000	64,000	55,000
TOTALS (Japan (Domestic)		834,000	651,000	624,000	437,000	491,000
(Formosa		8,000	5,000	7,000	9,000	7,000
(Korea		-	23,000	55,000	24,000	25,000
(Manchuria		-	2,500	17,000	29,000	39,000
GRAND TOTAL		842,000	681,500	703,000	499,000	562,000

Movement of Average Prices in the Tonkin Gulf Area (Unit: piasters)

Kind of Coal	1933	1934	1935	1936	1937	1938	1939	1940	194
Graded Coal	8.03	6.60	6.51	6.44	7.54	9.07	11.86	12.68	
Screened Coal	3.20	2.60	2.47	2.82	3.29	3.95	4.98	4.92	

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Prices of French Indo-China Coal FOB the Storage Area

Name of Coal	Kind of Coal	1940 1st Half	1940 2nd Half	1941 1st Half	1941 2nd Half	Note
Hongay	Large, Medium Lump	-	17.88	20.18	22.57	An operation of Japan Coal Co.
	Small Lump	-	16.00	18.01	20.14	(Price before
	Very Small Lump	-	13.70	15.57	17.41	(start not clear.
	Short Lump	-	12.25	13.83	15.49	(These prices
	Special Pwdr	-	10.62	12.03	13.48	(at 20% discount
	C Powder	-	9.60	10.88	12.12	Price at mine
	Fine Powder A	-	9.98	11.39	12.71	FOB OFFER Price (20% discount)-not yet set
	Fine Powder B					
	Fine Powder D	-	7.08	7.98	8.92	Price for 1942 still totally undecided.
Dong Trieu	Special Lump	-	18.11	19.11	22.34	
	Lump	-	16.46	17.86	21.10	
	Medium Lump	-	13.99	15.78	20.03	
	Small Lump	-	11.11	12.88	16.20	
	Special Powder	-	8.23	9.55	11.88	
	Powder	-	5.76	6.25	8.43	
	Fine Powder	-	4.12	4.99	5.90	
West Hongay (including Tambour coal)	A Powder	-	10.47	13.48		
	B Powder	-	9.24	11.76		

Costs to be Added to Base Prices of French Indo-China Coal in 2nd Half of 1941 and 1st Half of 1942 (Sea Freight)

(Unit: Yen)

	PORTS Port Courbet	Hongay - Campha	Le Dong
Tokyo-Yokohama	16.04	14.54	15.04
Ise Bay	16.04	14.54	15.04
Osaka-Kobe	15.54	14.04	14.54
Hiroshima	15.54	14.04	14.54

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	Port Courbet	Hongay - Campha	Le Dong
Hokuriku	-	15.04	15.54
Sakata	-	-	15.54
Tokuyama (Toyota)	15.54	14.04	14.54
Kyushu	15.54	14.04	14.54

Note: These costs include the cost of insurance - ¥0.34. These costs also include a surcharge of 20 sen for unloading at more than one port.

Import Prices for French-Indo-China Coal (Unit: Yen)

Mine	Kind of Coal	Kawasaki - Shibaura Yokohama - Nagoya			Osaka-Tokuyama-Miike Mikado-Wakayama-Nagasaki			Fusaki - Niigata Maezu		
		1940-2	1941-1	1941-2	1940-2	1941-1	1941-2	1940-2	1941-1	1941-2
Hongay	L & Med Lump	36.45	36.45	36.45	33.65	35.95	35.95	34.65	36.95	36.95
	SmlLump	32.27	34.28	34.28	31.77	33.78	33.78	32.77	34.78	34.78
	Vy Sml Lump	29.97	31.84	31.84	29.47	31.34	31.34	30.47	32.34	32.34
	Short Lump	28.52	30.00	30.09	28.02	29.59	29.59	29.02	30.59	30.53
	Sp Pwdr	26.89	28.30	38.30	26.39	27.80	27.80	27.39	28.80	28.80
	C Pwdr	25.87	27.15	27.15	25.37	26.65	26.65	26.37	27.65	27.65
	Fine A Powder	26.25	27.66	27.66	26.75	27.16	27.16	26.75	28.16	28.16
	Fine B Powder	24.97	26.08	26.08	24.47	25.58	25.58	25.47	26.58	26.58
	Fine D Powder	23.35	24.25	24.25	22.85	23.75	23.75	23.85	24.75	24.75
Dong Trieu	Sp Lump	35.38	35.88	35.88	34.17	35.68	35.68	35.38	36.38	36.38
	Lump	33.73	34.63	34.63	32.52	34.43	34.43	33.73	35.13	35.13
	M Lump	31.26	32.55	32.55	30.05	32.35	32.35	31.26	33.05	33.05
	S Lump	28.38	29.65	29.65	27.17	29.45	29.45	28.38	30.15	30.15
	Sp Pwdr	25.50	26.32	36.32	24.29	26.12	26.12	25.50	26.82	26.82
	Powder	28.03	23.62	23.62	21.82	23.42	23.42	23.03	24.12	24.12
	Fine Powder	21.39	21.76	21.76	20.18	21.56	21.56	21.39	22.26	22.26
	A Pwdr	29.39	31.24		29.39	31.24		29.39	31.24	
	B Pwdr	28.16	29.52		28.16	29.52		28.16	29.52	

On the System for Controlling the Importation of French Indo-Chinese Coal

The prices for French Indo-Chinese coal in our industries are fixed as to both quality and quantity for plain coal and compunded coal. The key note is more and more the priority importance given to productivity increases in French Indo-Chinese coal. In addition, from 1939 there has been the matter of exchange controls with the materials mobilization plan having been drawn up. The Fuels Office of the (Japanese) Ministry of Commerce and Industry took the initiative with imports controls and caused the "French Indo-China Coal Distribution Control Union" to be formed out of six companies - the five importers who had been importing French Indo-Chinese coal into Japan plus the importer of French Indo-Chinese coal into Korea, the Min Tek Trade Promotion Association (formerly M.T.M. Joint Trading company, Ltd.).

On the basis of the materials mobilization plan the union members enforced adherence to the set quota of imports for 1939, following the percentages of total imports they had handled in the past. Through the formation of this control union the mass of lesser importers could be blocked from taking advantage of the policy of moving southward and from causing useless competition by enroaching on the rightssof importers who had long since come to monopolize the imports.

Since the Mitsui Bussan, as chief director, brought in more than half of the imports, the controls were maintained harmoniously, even with all kinds of agreements extant.

As for the arrangements for importing the coal, the Japan Coal Company, Ltd., alone did the importing as the expediting organ of the union. The members of the French Indo-China Coal Distribution Control Union (the only Japanese importers), following their past experience were the ones entrusted with the importation of French Indo-Chinese coal through the Japan Coal Company, Ltd. And, they administered the breakdown when the coal arrived in the port offing. The union members

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were strengthened in their dealings through their relationship with the Japan Coal Company, Ltd. With this purpose, the control functions of the Japan Coal Company, Ltd., were very markedly strengthened.

Comprehensive Table of Importers of French Indo-China Coal

Producer	Agent	Capital	Importer	Address	Market Area
Tonkin Coal	Mitsui Bussan K.K. - Hanoi Branch Office	¥320,000,000	Mitsui Bussan K.K. - Azuma Trading Co.	Sogo Bldg. 2-1 Muromachi Nihon-Bashi Tokyo;	Japan,Korea, Manchuria, Formosa
			Azuma Trading Company	3-1 Kyobashi, Tokyo	Japan
Dong Trieu Coal	Comptoir des Charbonnages Indo-Chinois	Approx. 150,000 pia.	Iwai Shoten K. K.	4-43 Kitahama Higashi Ward Osaka	Japan and Manchuria
			Mitsui Bussan K. K.	(as above)	Manchuria
			Min Tok Trade Promotion Co.	4-775 Sendagaya Shibuya, Tokyo	Korea
Aleng et Dong Dang Coal	East Asia Coal	Approx. ¥200,000	East Asia (To-A) Coal Co. K.K.	2-12 Marunouchi Kojimachi Ward Tokyo	Japan
Neptune Coal Pits	(Formerly the Yasuda Yoko)	-	Ataka Company	5-14 Imabashi Higashi Ward Osaka	Japan

Agreement of the French Indo-China Coal Distribution Control Union

In March, 1939, under sponsorship of the Ministry of Commerce and Industry the French Indo-China Coal Distribution Control Union was formed by those importing French Indo-China coal into Japan. Since then, they have carried out their duties under the following union agreement:

Chapter 1. General Articles

ARTICLE I This union shall be called the French Indo-China Coal Distribution Control Union.

ARTICLE II This union is organized for the purpose of importing and marketting French Indo-China anthracite (hereafter called FIC Coal).

ARTICLE III This union shall control imports of FIC coal and has the goal of planning its reasonable distribution.

ARTICLE IV This union shall maintain an office in metropolitan Tokyo.

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Chapter 2 Activities

ARTICLE V In order to achieve these goals, this union shall carry on the following activities:

1. Matters relating to the allocation of amounts imported.
2. Matters relating to the allocation of the supply.
3. Matters relating to the regulation of the market price.
4. Matters relating to procedures and negotiations with the government.
5. Matters relating to the increase in profits to union members.
6. Other necessary matters for advancing the aims of this union.

ARTICLE VI The matters in the previous Article pertaining to the import supply and market prices shall rely upon the Ministry of Commerce and Industry for guidance and shall follow out such guidance.

Chapter 3 Union Members

ARTICLE VII The following listed members shall be the members of union:

Stock Company	Iwai Shoten
"	Ataka Company
"	Min Tok Trade Promotion Association (M.T.M. Joint Trading Company, Ltd.)
"	
"	East Asia Coal Company (Tc-A)
"	Mitsui Bussan

ARTICLE VIII Entry into, or withdrawal from the union shall require the approval of the council of union members.

ARTICLE IX Whenever there is any violation of this union's articles by a union member, the council of union members shall issue a warning; and if the violation still goes uncorrected, the council of union members may expel the member.

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Chapter 4 Officials

ARTICLE X There shall be the following officers in this union:

1 Director-in-Chief

1 Director

ARTICLE XI These officers shall be determined through election by the union members. The term of office shall be one year. However, their re-election is not prohibited.

ARTICLE XII The Director-in-Chief shall represent the union and shall supervise the affairs of the union. The director shall assist the director-in-chief and shall be the union's representative in the absence of the director-in-chief.

Chapter 5 Council of Union Members

ARTICLE XIII The council of union members shall be called into session once each month and shall decide upon important matters. However, it shall be possible to postpone the meeting until the next date for the regular session when it is necessary for members to be absent.

ARTICLE XIV The decisions of the council of union members shall require unanimous approval of all the union members. However, when a decision is to be rendered in accordance with Article IX, the offending union member shall not be permitted to participate in the decision.

Chapter 6 Finances

ARTICLE XV Expenditures of this union shall be charged to each union member.

ARTICLE XVI Union members shall deposit ¥500 to maintain the union's principles.

ARTICLE XVII The fiscal year for this union's finances shall begin on April 1 of each year and run through to the last day of March of the following year.

Appended Regulations

ARTICLE XVIII Revision of this union's Articles shall require the approval of the council of union members.

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ARTICLE XIX Minor regulations may be decided upon when necessary to effectuate the functioning of this union.

ARTICLE XX The Articles of this union shall be effective from March 1, 1939.

Section 6 Briquette Coal and Coke

1. Briquette Coal

Almost all of the coal produced in French Indo-China is anthracite with no capability of being used for coke, so that the only bituminous coal available for the necessary mixing coal in the manufacture of coke and briquette coal is the small amount produced by the Phan-me Coal Mines. Thus, bituminous coal, as well as pitch, has to be supplied from overseas.

Although most of the coking quality coal received has been the supply of Miike Mines powder coal from our country, while most of the pitch once came from Odessa in the Soviet Union, since the outbreak of the present disturbances both of these items became difficult to obtain - so much so that in late 1940 the point was reached where it was thought that the manufacture of briquette coal would have to be halted.

However, at the end of that same year, 14,600 tons of pitch were shipped in; and in January, 1941, a small amount of bituminous coal was included in the freight arriving. As a consequence, the authorities gave their most serious attention to the manufacture of briquette coal, ceasing the production of coke from Phan-me coal. By bending every effort, they are barely able to obtain the raw materials for briquette coal. And, when the supply routes of the Japanese Army were interrupted in 1940 with the halting of imports of briquette coal from China along the Yunnan Railway, it was still possible, then, to maintain the levels of supply in Japan.

As for the import of pitch, although it had been possible to procure American pitch - high priced as it was - with the outbreak of the Greater East Asia War this was stopped. Hereafter, we must await results of studies on the use of Pacific Petroleum pitch.

The Status of Procurement of Pitch and Bituminous Coal for Use in Briquette Coal Manufacture

The Status of the Tonkin Coal Mining Company's Use and Procurement of Coal for the Hongay Factories (1940) Unit: tons

Source of Coking Coal Procured	Stock at end 1939	Amount of Import	Amount Used	Stock at end 1940
Using Phan-me coke	0	1481	1481	0
Using Phan-me briq.	0	1473	1236	237
Miike	650	11,653	12,303	0
Palambang	1046	3520	4566	0
Victoria	2136	0	2136	0
Parias (phonetic)	2311	0	2311	0
London	1939	0	1939	0
TOTALS	8082	18,127	25,972	237
Imported Coal	8082	15,173	23,255	0

Status of Import and Use of Pitch

Source of Pitch Procured	Stock at end 1939	Amount Imported	Amount Used	Stock at end 1940
Odessa, USSR	3941	0	3941	0
Shanghai	0	378	378	0
Great Britain	0	14,605	4879	9726
Japan	0	501	501	0
TOTALS	3941	15,484	9699	9726

The stock at the end of 1940, i.e. 9,727 tons, just barely provided for a year's needs. When the survey was made of the coal banks in the Hongay factories in January, 1942, it was found that there were no more than 200 tons in stock.

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The processing of briquette coal in French Indo-China is handled only in the Tinkin Coal Mining Company's Hongay factories and in the Dong Trieu Coal Mining Company's factories. But, the latter only processed enough for its own consumption in both 1938 and 1939. In the Hongay factories of the Tonkin Coal Mining Company there are three Bietrix-type and two Middleton-type steam-powered briquette manufacturing machines with a total productive capacity of 500 tons per day.

The following is a comparison of warship- and steamship-grade briquette coal in French Indo-China with Hongay briquette coal. (Analysis in Japan by Japan Coal Company, Ltd.)

	Water Content	Volatile Elements	Ash Content	Solid Carbon	Sulfur	Caloric Value
Warship use	-	17 - 19%	6 - 7%	74-77%	0.75%	8100
Steamship use	-	16 - 18	7 - 8	74-77	1.00	7700-7800
Hongay briquette	2.31%	17.93	7.57	72.19	0.84	7759

Status of Production and Supply of Briquette Coal

(Unit: 1000 tons)

		1935	1936	1937	1938	1939	1940
Producing Factory	(Hongay Coal	71.0	104.5	132.0	126.0	183.7	140.1
	(Dong Trieu Coal	0	0	0	5.5	1.7	0
	(Sub-total)	71.0	104.5	132.0	131.5	185.4	140.1
Previous year's Stock		18.2	11.2	12.7	39.7	40.2	19.9
	TOTAL	89.2	115.7	144.7	151.2	225.6	160.0
Domestic Consumption and exports		70.0	103.0	105.0	131.0	205.7	133.6
Previous year's Stock (sic)		11.2	12.7	39.7	40.2	19.9	26.4

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Distribution of Briquette Coal (Unit: tons)

		1939	1940
Coal Mine Consumption	(Hongay Mines	18,782	13,153
	(Dong Trieu Mines	1,746	-
	(Sub-total)	20,528	13,153
French Indo-China Dom. Consumption	(Tonkin	68,502	33,950
	(Annam	18,965	23,712
	(Cochin China	44,416	35,435
	(Sub-Total)	131,883	93,103
Exports	(French colonies	21,250	4,600
	(China	16,153	3,143
	(Thailand	2,363	0
	(Philippines	5,981	12,369
	(Others	7,509	7,259
	(Sub-total)	53,256	27,371
GRAND TOTAL		205,667	133,627

Note: Briquette produced by S.C.D.T. in 1939 was used up at the minesite.

There are four kinds of French Indo-China briquette coal: "Naval briquettes", "marine briquettes", "bituminous eggs" and "anthracite eggs". The first of these so-called briquettes furnishes most of the power source for the Far Eastern Fleet, ordinary shipping and railways. Bituminous eggs, which measure 27cm x 17cm x 9 cm and weigh about 6 kilograms, have the same composition and are used for the same purposes as marine briquettes. Anthracite eggs are chiefly used for domestic fuel.

2. Coke

After 1933 coke was chiefly manufactured at the Phan-me coal mines; but since 1938, the coke-producing industry at the Tonkin Coal Mining Company's Hongay factories has been revived and, with its nine Coppe-type furnaces, is going ahead with production of coke for use chiefly in making castings.

This is our analysis of its composition:

	Water	Ash	Volatile Elements	Solid Carbon	Caloric Value
Hongay coke	1.73%	13.58	3.10	81.59	6,784

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Most recently, with the difficulty in importing bituminous coal which is used in mixed coal and with major attention being given to the production of briquette coal, the production of coke has come to be extremely limited. The present situation in coke production is shown below:

(Unit: tons)

	1935	1936	1937	1938	1939	1940
Hongay Coal Mines	0	0	0	3451	4022	2603
Phan-me Coal Mines	260	109	128	52	0	0
TOTAL	260	109	128	3503	4022	2603
Mine Consumption & Amount marketted	1000	1000	1556	2848	2850	4596
Breakdown (S. F. C. T.					2207	4101
Breakdown (Imports					643	495
Stock December 31				2209	3843	2341

Coke Distribution Situation (Unit: tons)

		1939		1940	
Mine Consumption			173		170
Domestic Market	Tonkin	841	1270	1338	2114
	Annam	124		141	
	Cochin	305		635	
Coke Imports			643		495
TOTAL DOMESTIC CONSUMPTION			2086		2779
Exports	French Colonies	30	764	0	1817 (sic)
	Hong Kong	0		911	
	Shanghai	561		0	
	Thailand	173		424	
	Manila	0		4026	
GRAND TOTAL OF COKE DISTRIBUTION			2850		4596

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Section 7 Labor Conditions

1. Summary

The area of French Indo-China is about 740,000 square kilometers - about 1.1 times the size of Japan.* The populationis about 2,300,000, and is mainly concentrated in the lowlands along the rivers and the seacoast;and especially in the lower reaches of the Red River of Tonkin - the so-called Tonkin Delta - the population is overhwelmingly dense. This phenomenon is explained by the fact that since olden times French Indo-China has been an agricultural country (90 to 95% of the population being occupied in agreculture). These people have been making land and water the base for their way of life and managing an agiricultural system organized on the basis of the tradition offamily cultivation of the land. Thus, even when the population density is more than 430 per square kilometer as in the Red River's lower reaches in the Tonkin Delta, they stick with their tiny plots of land and are contented to go on conducting their land cultivation under a feudal type of system, maintaining an agricul-ture of a low-grade technology. These super-abundant low-class peasants form the labor supply for the modern enterprises: the coal-mining industry and other activities.

The number of laborers in the mining industry during the last ten years was as follows:

Race	1931	1932	1933	1934	1935	1936	1937	1938	1939	1940
Europeans	350	250	220	2000	201	212	271	265	239	200
Asians	30,000	33,500	35,400	34,800	39,000	43,850	49,200	52,600	55,000	52,200
(Portion in coal mining)	-	-	29,780	30,000	34,000	37,205	40,580	44,228	43,002	39,444

Note: The Asians shown are the average stationary labor supply. Among the coal-mine workers, the permanent laborers constitute 60%. If the number of permanent and temporary workers are added together, they number 90,000.

Now, if we distinguish among the Asian laborers their state and province in the year 1939:

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Place of Origin	Actual Number	Percentage
Tonkin	48,575	88.7%
Annam	3,015	5.4
Laos	2,110	3.5
Cambodia	1,300	2.4
TOTAL	55,000	100.0

Looking at the above table, we see that the Tonkin area is the source of close to 90% of the labor supply. The various coal mines neighboring on the Tonkin Delta use all sorts of cajolery on the destitute, crowded people to get them into modern capitalistic production. This illustrates how they bend every effort to absorb labor power, even more than one would assume. Mining work, and especially digging underground resources is held in dread by these people, who have fallen into a slack way of living. The requirements for great masses of labor for the plantations and industries suddenly developing of late, as well as the requirements for men for military duty in the war and in the constructionsof rail-ways for military use are the biggest reasons for the labor crisis.

As a remedy for this, French Indo-Chinese authorities have instituted since the last half of 1939 various measures such as 1) the simplification of mediation procedures for labor difficulties in mining operations (Decree of the Government General on August 3, 1939), 2) a special enactment for youths of 15 to 18 years of age working under-ground (Decree of the Government General on September 11, 1939), 3) the revision of wartime working hours in various enterprises (Decrees of the Government General on September 3 and 20, 1939), and other decrees for raising general minimum wages and for arbitrating cases where labor rest periods have been refused or overtime demanded - all social policies for protecting native labor were however avoided, in line with the traditions of French colonial policies, which strengthen the French intrepreneurs at the expense of the native inhabitants.

2. European Employees

Many of the European employees are of southern French extraction and have the advantage of a thorough French education. They are able

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to handle skillfully the foremen who understand French. Although they have had to take charge of from 100 to 200 laborers each, with the effects of the 2nd World War becoming felt after 1938, the numbers of employees gradually decreased; and the reaction on the employees in French Indo-China was even greater than on employees in France Proper. We must consider the main reasons for this as

1) French Indo-China, as a developing colony, is not run for the welfare of the colonial peoples; and the development of all kinds of activities is influenced by the various effects of the war, with a major effect on the French mother-land,

2) The salaries of the Europeans are quite large, so that even in peacetime that staff is strictly held to the smallest limits,

3) In consideration of such things as climate and weather in French Indo-China, the number of adults in general is high, and not many of them can avoid military duty.

Thus, the decrease in European employees gives birth to laxity through insufficient supervisory guidance being provided for employees. One effect is to induce a trend toward an increase in accidents as shown in a separate classed table of statistics of mining accidents. (~~Not~~ On ~~included in~~ pages 22a-d of text - TRANSLATOR).

3. Asians

As stated above, it is natural that the coal mines in the Tonkin and Annam delta areas - i.e., the overpopulated regions - should draw upon the reservoir of labor power from among the super-numerous peasants; but, nevertheless we wish to mention briefly how it happens that so many of these are Annamese.

The Annamese population is about 73% of the total population, or about 1,700,000, and lives on the flatlands of Tonkin, Annam and Cochin China. For the most part, they subsist on agriculture. And, a greater part of them remain unschooled and unskilled, keeping a strong attachment for their small plots of land and following a simple peasant life. Thus, the places where the Annamese live can invariably be described as rice paddy land. Their physique is generally poor, and as manual laborers they have the failing of lacking endurance. They manifest strong love of their native villages and hold to their place of birth as the land inherited from their ancestors, contenting themselves with a poor peasant existence and thus with existing on coarse foods. So, they show physical dgeneration resulting from locally endemic diseases which are caused by a lack of a sense of hygiene and chronic dietary deficiencies. Yet, judging from the improvement in the physical qualities of Annamese soldiers and prisoners in French Indo-China, one could assume it to be possible to halt the lowering of their physical strength if they would eat properly and follow a regimen of physical calisthenics.

Thus, as characteristic of natives of the tropics, they find that the surrounding environment provided by nature does not make it difficult to obtain clothing, food and shelter; the things needed for carrying on everyday living can easily be acquired. So, they have an aversion for laboring, they love gambling and lack perseverence in their work. The publication Asie Francaise Decembre 1908 says:

> "Annamese laborers are accustomed to a small diet, but on the other hand they are capricious about their work because the wages earned in the coal mines are comparatively high. By working one week they can earn enough to live on for two weeks. So, the coal-mine operators must have access to twice as many laborers as are needed to actually do the work."

Thus, the Annamese, under extreme pressure to leave their villages, are drawn into the wage-labor system of the mines by guileful words which take advantage of their poverty-stricken way of living. Yet when the period of the contract us up, they leave their work and go back to the village. For this reason, to this day tye remain unemancipated, and the social system holding strong sway here keeps the peasants of the Tonkin Delta forever tied to the land of their ancestors' graves and prevents their developing into a modern labor force. As one example of this , the presentincrease in the number of laborers in small-scale mining may be compared with the decrease in the number of laborers in the big companies. Still, while it is comparatively easy to find several hundred temporary laborers, it is extremely difficult to get them to

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transfer to the region of the big mines. In the words of the manager of the Dong Trieu Coal Mines:

> "Most coal-mine operators' employment of large numbers of low-wage laborers so as to get large profits for the enterprise may be general common sense; but at present for these mines to get coolies it is necessary to aim at twice the needed number of individuals. And, the time and troubel and expense required for this - the re-training of the hired coolies, the fall in labor productivity and high wage costs through turnover - are all great obstacles to such enterprises."

Also, the coal mines of French Indo-China supplement their labor force by working without holidays.

Number of Laborers in Coal Mines During the Past Three Years

	1938	1939	1940
(1) Anthracite			
S.E.C.T.	31,254	29,315	28,053
S.C.D.T.	9,213	9,750	6,969
Along et Dong Dang	550	750	900
Tambour	539	515	716
Neptune	353	353	319
Chacha	394	400	311
Ca-Kenh	241	74	53
Bicho	197	132	204
Printemp	310	160	145
Esperance	50	30	40
Emile	10	60	10
Marcelle	18	15	0
Van-nho	-	14	42
Paul	-	0	103
Thi-Hue	-	0	50
Song Au Dzuong	-	0	19
Thai-loc	-	0	13
TOTAL des Bassin Auang-yen	43,134	41,568	37,947
Phu-Lang-Thuong Bo-Ha	37	185	150
Uoe-Le	-	0	10
Phuto Richesse	20	77	67

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Dong Viet	47	0	0
(Sub-Total)	104	262	242
TOTAL - ANTHRACITE	43,238	41,930	38,189
(2) Bituminous			
Phan-me	600	652	766
Tuyen-quang	390	481	444
Loc-Binh	-	24	10
Yen Bay	-	0	15
TOTAL - BITUMINOUS	990	1,157	1,235
(3) Semi-bituminous			
Nongson	-	7	7
Surprise (Hoa-Binh)	-	8	20
TOTAL - SEMI-BITUMINOUS	-	15	27
GRAND TOTAL - ALL COAL	44,228	43,002	39,444

4. Labor Efficiency and Accidents

It was noted above that because of the disadvantages of Annamese labor conditions, because of the passivity of the French Indo-China coal-mine operators with respect to developmental technology through the interaction of their viewpoint on profits and their relationships with industries in the French homeland, and despite the previously followed practice of digging good-quality, thick-seam coal around the outcroppings, the extraction efficiency is low as compared with that of the world's other coal-producing nations. Thus, even the trend toward reforms will probably not accomplish much.

Table of Coal Extraction by Mining Nations During the Past Ten Years (Per person per year; Unit - tons)

	1931	1932	1933	1934	1935	1936	1937	1938	1939	1940
French Indo-China	56	53	54	53	52	59	58	53	61	63
Japan	181	203	227	213	216	211	203	185	174	172
Germany (Ruhr)	363	386	398	433	448	478	476	-	-	-
France	184	185	198	210	215	211	198	-	-	-

As shown above, extraction by the Indo-Chinese miner is one-third as efficient as that of the Japanese miner and one-seventh as efficient as that of the German miner. The efficiency increase in the last three years is actually not due to an improvement in labor efficiency, but was stimulated by the sudden rise in coal prices. The bolstering of output through incentive wages paid to the laborers, plus the halting of extraction from the pits in favor of the better conditions of open-air digging, using women and children labprers as the decrease in labor supply developed, led to the planned increase in coal extraction. This was the origin of the strengthening of labor supply through coercion and was the immediate cause of the depletion of the labor supply. The continuing insufficiency of the numbers of miners finally led in 1940 to a decrease in the amount produced.

Thus, the past policy of using low-wage native labor for the French Indo-China mines has permitted no efficiency increase through instituting modern extractive methods or the equipping of the mines with modern machinery. Added to this, the decrease in the number of European supervisors because of the drafting of Frenchmen as a facet of the outbreak of the second general European war gave rise to technological defects in all areas. Together with the inadequacies of the Government-General, these factors have brewed up the tendency for an increase in mining accidents.

French Indo-Chinese coal mines engage in no deep mining whatsoever of the type seen in our country. Instead, since the open-air method of extraction is engaged in, there is no danger of methane gas, and there are accidents no more serious than the minor explosions seen in the small bituminous and semi-bituminous mines. And, even these have amounted to just four accidents in the past five years, with six victims killed and four seriously wounded. Rather than calling them explosion accidents, they should be called gas-ignition accidents. Other kinds of important accidents which can be mentioned in addition are mining car accidents and those caused by rock slides and avalanches following after torrential rains and floods.

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The numbers of persons killed and persons injured per million tons of coal extracted are respectively 35.2 and 66.4. The numbers per thousand miners are 2.26 killed and 4.26 injured. In comparison with the rate in our country, the ratio of persons killed to the amount of coal extracted is greater, while the ratio of persons killed to the overall number of miners is less. It is felt that the smaller number of victims means that efficiency in coal extraction is poor, but the conditions of open-air digging are favorable.

Yet, in the future, as the French Indo-Chinese coal fields are led into the development of deeper mining, they may be unable to avoid a lowering of efficiency under the present technology.

Efficiency of Coal Extraction by Major Mines

(Per person per year - in tons)

	1938	1939	1940
S.F.C.T.	52.6	60.9	61.0
S.C.D.T.	49.7	57.7	69.5
Along et Dong Dang	99.3	85.4	77.1
Tambour	63.3	51.3	73.4
Neptune	52.7	98.1	81.3
Chacha	123.9	114.4	130.5
Co-Kenh	46.0	173.8	86.3
Bi-cho	17.7	44.3	41.8
Phan-me	52.8	51.5	51.7
Tuyen-quang	59.0	41.9	34.5
TOTAL (Average? - Trans.)	52.7	60.8	63.4

(Two tables of Accidents on following attached pages)

5. Wages

The sudden rise in the laborers' cost of living because of the precipitous jump in the prices of goods after the recent Great European War had heightened social disruption and led to the outbreak of labor struggles for wage increases. As a result, there was a 10% increases

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Statistics of Mining Accidents Per 1000 Persons and Per 1,000,000 Tons

	No. of Accidents			Dead			Injured			No. Per Million Tons			Per Thousand Persons		
	In Pit	Outside	Total	In Pit	Outside	Total	In Pit	Outside	Total	Number	Dead	Injured	Number	Dead	Injured
1937	100	49	149	44	17	61	67	34	101	64.78	26.52	43.91	3.63	1.49	2.46
1938	166	43	209	64	11	75	123	39	162	90.87	32.61	70.43	4.75	1.71	3.68
1939	206	52	258	48	10	58	167	44	211	99.23	22.31	81.23	6.06	1.35	4.91
1940	154	41	195	78	10	88	135	31	166	78.00	35.20	66.40	4.87	2.26	4.26

Table of Accidents - 1937

Cause	No. of Accidents				In Pit		Outside Pit		Totals			
	In Pit	Outside	Total	%	Dead	Injured	Dead	Injured	Dead	Injured	Total	%
Falls	18	2	20	13.4	16	3	1	1	17	4	21	13.0
Falling Rock, etc.	23	1	24	16.1	5	18	-	1	5	19	24	14.8
Mine cars	25	7	32	21.5	5	20	2	6	7	26	33	20.3
Pit slide	2	-	2	1.3	1	1	-	-	1	1	2	1.2
Suffocation	1	-	1	0.7	1	-	-	-	1	-	1	0.6
Gas explosn	1	-	1	0.7	3	-	-	-	3	-	3	1.9
Electrocutn	2	2	4	2.6	2	-	2	-	4	-	4	2.5
Aerial cable	2	-	2	1.3	-	2	-	-	-	2	2	1.2
Railway	-	13	13	8.8	-	-	4	10	4	10	14	8.7
Explosives	6	-	6	4.2	3	7	-	-	3	7	10	6.2
Cave-in	5	3	8	5.8	2	3	-	3	2	6	8	4.9
Shaft	4	-	4	2.6	1	4	-	-	1	4	5	3.1
Others	11	21	32	21.5	5	9	8	13	13	22	35	21.6
TOTALS	100	49	149	100.0	44	67	17	34	61	101	162	100.0

Table of Accidents - 1938

Cause	Number of Accidents				In Pit		Outside Pit		Totals			
	In Pit	Outside	Total	%	Dead	Injured	Dead	Injured	Dead	Injured	Total	%
Falls	22	-	22	10.5	32	5	-	-	32	5	37	15.6
Falling Rock,etc.	34	-	34	16.3	4	29	-	-	4	29	33	14.0
Mine cars	53	17	70	33.5	11	42	5	13	16	55	71	30.0
Pit slide	8	-	8	3.8	1	8	-	-	1	8	9	3.8
Suffocation	4	-	4	1.9	5	-	-	-	5	-	5	2.1
Gas explosion	3	-	3	1.4	3	4	-	-	3	4	7	2.9
Electrocution	1	-	1	0.5	1	-	-	-	1	-	1	0.4
Aerial Cable	-	-	-	-	-	-	-	-	-	-	-	-
Railway	-	3	3	1.4	-	-	2	1	2	1	3	1.3
Explosives	8	-	8	3.8	3	6	-	-	3	6	9	3.8
Cave-in	10	1	11	5.3	2	8	1	-	3	8	11	4.6
Shaft	2	-	2	1.0	1	1	-	-	1	1	2	0.8
Others	21	22	43	20.6	1	20	3	25	4	45	49	20.7
TOTALS	166	43	209	100.0	64	123	11	39	75	162	237	100.0

Table of Accidents - 1939

Cause	Number of Accidents				In Pit		Outside Pit		Totals			
	In Pit	Outside	Total	%	Dead	Injured	Dead	Injured	Dead	Injured	Total	%
Falls	16	-	16	6.2	19	-	-	-	19	-	19	7.1
Falling rock,etc.	55	-	55	21.3	8	49	-	-	8	49	57	21.2
Mine Cars	69	16	85	33.0	4	66	3	13	7	79	86	32.0
Pit Slide	13	-	13	5.0	7	7	-	-	7	7	14	5.2

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Cause	Number of Accidents In Pit	Outside	Total	%	Y In Pit Dead	Injured	Outside Pit Dead	Injured	Totals Dead	Injured	Total	%
Suffocation	-	-	-	-	-	-	-	-	-	-	-	-
Gas Explosion	-	-	-	-	-	-	-	-	-	-	-	-
Electrocution	-	-	-	-	-	-	-	-	-	-	-	-
Aerial cable	-	-	-	-	-	-	-	-	-	-	-	-
Railway	2	6	8	3.1	-	2	2	4	2	6	8	3.0
Explosives	8	1	9	3.5	2	7	-	1	2	8	10	3.7
Cave-in	21	5	26	10.1	3	19	-	5	3	24	27	10.0
Others	22	24	46	17.8	5	17	5	21	10	38	48	17.8
TOTALS	206	52	258	100.0	48	167	10	44	58	211	269	100.0

Table of Accidents - 1959

Cause												
Falls	19	-	19	9.8	15	9	-	-	15	9	24	11.8
Falling rock, etc.	28	2	30	15.4	6	22	-	2	6	24	30	14.7
Mine cars	58	9	67	34.3	1	57	1	8	2	65	67	32.8
Pit slide	11	-	11	5.6	1	11	-	-	1	11	12	5.9
Suffocation	1	-	1	0.5	2	-	-	2	2	2	2	1.0
Gas explosion	-	-	-	-	-	-	-	-	-	-	-	-
Electrocution	-	2	2	1.0	-	-	2	-	2	-	2	1.0
Aerial cable	-	-	-	-	-	-	-	-	-	-	-	-
Railway	-	3	3	1.5	-	-	3	-	3	-	3	1.5
Explosives	5	2	7	3.6	1	6	-	2	1	8	9	4.4
Cave-in	11	8	19	9.8	-	11	2	6	2	17	19	9.3
Others	21	15	36	18.5	2	19	2	13	4	32	36	17.6
TOTALS	154	41	195	100.0	38	135	10	31	38	166	204	100.0

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Table of Accidents - 1941

Cause	Number of Accidents				In Pit		Outside Pit		Totals			
	In Pit	Outside	Total	%	Dead	Injured	Dead	Injured	Dead	Injured	Total	%
Falls	19	1	20	10.9	25	4	-	1	25	5	30	15.2
Falling rock,etc.	40	1	41	22.4	9	31	-	1	9	32	41	20.8
Mine cars	41	3	44	24.0	3	38	-	3	3	41	44	22.4
Pit slide	6	-	6	3.3	1	5	-	-	1	5	6	3.1
Suffocation	2	-	2	1.1	2	4	-	-	2	4	6	3.1
Gas Explosion	-	-	-	-	-	-	-	-	-	-	-	-
Electrocution	1	-	1	0.6	1	-	-	-	1	-	1	0.5
Aerial cable	1	-	1	0.6	-	1	-	-	-	1	1	0.5
Railway	-	5	5	2.7	-	-	4	1	4	1	5	2.5
Explosives	3	-	3	1.6	-	3	-	-	-	3	3	1.5
Cave-in	23	4	27	14.8	22	21	1	3	3	24	27	13.7
Others	18	15	33	18.0	1	17	2	13	3	30	33	16.8
TOTALS	154	29	183	100.0	44	124	7	22	51	146	197	100.0

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in wages by decree of the Government-General in July, 1935. This took the form of an increase in the basic wage, seasonal and production-incentive wages, plus a lowering of the price of rationed rice. But, this wage increase had very disastrous effects, stepping up the idleness of the laborers and decreasing their extractive efficiency. Judging from this, it would seem that the Annamese want to get the lowest possible cost of living from the very minimum amount of labor; and they have no sense of working for savings. In the Dong Trieu mines, they tried in vain to avoid the foolishness of paying high wages, supplying the laborers with nutritious dietary goods instead so as to make the laborers feel attracted toward putting more energy into their work at the mines. Thus, they were concerned with the maintenance of labor power through a policy of giving what was nevertheless essentially a high wage. Consequently, in terms of the basic value of wages, the wages paid by the big mines was high as compared with others. And, the wage of the coal miners of the Tonkin Delta region was 20 - 30% more than that of the farther mines or even of mines in nearby regions.

Table of Average Wages by Occupation in Jan.-Feb., 1942

(Unit: piasters)

	Coal Diggers	Support Employees	Transport Workers	Coal Sorters	Miscellaneous Employees
Tonkin Coal Mines	0.5	0.5	0.35	0.175	0.35
Dong Trieu Coal Mining Company	0.6	0.58	0.35	0.45	0.35
Tuyen-quang Coal Mining Company	0.65	0.65	0.55	0.50	0.35

The wage for women and children is generally 5 - 10% lower than the general wage. Of course, French employees receive wages at a far higher rate than do these Annamese.

6. Welfare Facilities

The three great mottoes under which France was established - Liberty, Fraternity and Equality - express a humanism which applies only among the French people. In French Indo-China this phase of

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social living is discarded: a superiority complex discriminating between victor and vanquished and superior race from inferior race is reflected in all sorts of policies. With all their concern for the profit-making monopolies of the French motherland, the French extend none to the unenlightened and impoverished natives. Thus, whereas in the case of the two biggest coal mining companies in French Indo-China there are arrangements for housing, normal educational schools, religious meeting places, playgrounds and water supply and sewage, far more are provided for the use of the French dependents. Among the small coal mining companies, grass huts are provided , and there are not even any sanitary facilities. In the past, the spirit under which social facilities were established in conjunction with French Indo-Chinese coal mines was not one demonstrating positive policies for protecting labor. But, in most recent times, policies for relieving the suffering of the laborers are being followed; the operators are making efforts to increase the provisions for more facilities.

New social facilities recorded for 1939 were as follows:

1. Tonkin Coal Mining Company

Construction of 291 laborers' houses and 11 residence halls for native employees, construction of one school and the two-ward Georges Pircaux (?) Hospital, and the construction of drinking-water systems for the villages.

2. Dong Trieu Coal Mining Company

Continuation of plans for construction of laborers' houses begun in 1938, including kitchens and lavatory facilities, and 14 two-family dwelling units; construction of 2979-square-meters hall for use of merchants in Clotilde village.

3. Tuyen-quang Coal Mining Company

Straw-thatch houses are being built for laborers desiring housing, and twenty houses are being constructed with electric lighting and running water. In recognition of the recent low rate at which workers' needs were met, the company is taking up the education of the Annamese natives. The work is going on extremely slowly; but they are trying to reform the natives' idle habits and are moving ahead with their plans step by step. Thus, there are such welfare organs for the workers as the workers' supervisory school of the Tonkin Coal Mining Company and the Dong Trieu Coal Mining Company's training school for miners - both of which are under the practical guidance and control of Europeans, so that they are now seeking to improve the workers. But, such plans are not yet at the stage of full realization.

c o n t i n u a t i o n

Excerpts from Mineral Resources; Reports of the French Indo-China Survey Group, Part I, Volume 1.

Chapter 2

Anthracite Mining Companies

Section 1 Tonkin Coal Mining Company (Societé Francaise des Char-Bonnages du Tonkin)

(Note: The Tonkin Coal Mining Company's affiliate, the Mao Cay Coal Mine, is discussed in Section 4.)

1. History

In 1865 digging was begun on exposed coal outcroppings near the present Hatou pit by the Chinese. And, by means of the 1886 Tientsin Treaty French Indo-China became a protectorate of France. Prior to this, in 1884, the Tuchs-Saladin surveyors, and in 1885 the Sarran surveyors, had conducted surveys of the said coal mines. Also in 1884, the Frenchman Bavier Chauftan received title to the Along Bay coal-fields area from the Annamese government in consideration for 100,000 piasters. Finally, in August, 1887, the Government General of Tonkin requested the establishment of a coal-mining company. And, under the articles of a special agreement the Hongay Coal Mining Company was established with a capitalization of 4,000,000 francs.

The early period of the company, since it was a period of opening up the coal mines, saw but a small amount of coal extracted and sent to very limited markets. As a result, unstable conditions continued for some time. But, in 1928 the capitalization was increased by 400,000 francs. And, in July, 1933, the Societe des Anthracites du Tonkin (working the mining area of Mao Cay) merger with the Societe du Domain de Kebao (working the mining area of Kebao) was realized, with an increased capital of 39,925,000 francs.

Thus, the company's enterprises graudally came into bitter times. After 1930, even in times of unsettled world conditions, the rate of business return was maintained. In 1930, for example, it was 30%; in 1937, 46.8% and in 1938, 65.5%. However, in 1941 with the outbreak of the Greater East Asia War, previously supplied markets became very much monopolized. Exports to the French motherland, to Europe and to America became impossible. Since our country alone remains as a supplied country, the Tonkin Coal Mining Company, which had not given attention to transports, is in the sad condition of needing to curtail production because of the shortage of shipping, and yet being unable to;

The mining area of the Tonkin Coal Mining Company is 54,281 hectares (including 24,689 hectares presently being worked). The amount produced is 70 to 80% of the total amount of coal extracted in French Indo-China (in 1940). These are pre-eminent coal mines in the Far East.

Company founded:	April, 1888
Capitalization:	100,604,000 francs
Location of Company:	64 Rue de la Chausee d'Antin, Paris
Office Location (Current):	Hongay (Province de Quang-yen, Tonkin)
Office (Marketting):	Haiphong & Rue Francis-Garnier
Purpose of Operations:	Development of Coal Mines and related industries, especially operations developing coal mining areas on the coast of the Bay of Along.

Breakdown of Capitalization Increases
(Unit: 1000 francs)

1888	4,000	
1896	6,000	
1898	4,000	
1920	8,000	
1922	16,000	
1928	33,400	
1933	39,925	In July of 1933, purchased Societe du Domaine de Kebao and amalgamated with Societe des Anthracites du Tonkin.
1936	48,912.75	
1937	59,170.75	
1939	85,769.25	
1940	100,604	

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The Hongay Mines   Unit: hectares

	Name	Area
Working Mine Area	Hongay	22,639
Idle Mine Area	Kebao	15,000
	TOTAL	37,639

Finally, we may list the areas developed by the Hongay Mines: 1) Halam, 2) Hatou, 3) Campha, 4) Mong-Dzuong and 5) Courbet, Nagotna.

2. Location, Communications, Geographical Features

A. Location and Communications

The mining area of Hongay Coal Mines is in the Tonkin region - Quang-yen Province - and extends from Hongay City for 40 kilometers (in a direct line) to the coast in the Haiphong area. To the east it runs to Kebao Island - about 60 kilometers - all in all occupying an area of 60 kilometers from east to west and 9 kilometers from north to south.

Within this area, communications to Kebao Island are inconvenient and the coal seams on Kebao are not faverable for development. Thus, modern-type extraction of coal is held back.

The area now being worked by Hongay Coal Mines is breadly divisible into the Hatou-Halam region and the Campha-Mong-Dzuong region. Since the region between these two areas either has no discovered coal or has unfavorable conditions for development, there is no working of any coal here. Near to the exposed outcroppings of both regions there has in the past been small-scale digging of coal (chiefly digging with picks or mattocks). There is much evidence of the past digging of this type.

The coal dug in the pits of Hatou and Halam is shipped from Hongay Port. That from Campha and Mong-Dzuong is shipped from Campha Port.

Going from Haiphong to Hongay, the land route is 70 kilometers, with improved roads. The trip takes an automobile about two hours. (There are three ferry points along the way.) Thus the city of Hongay are the coal mine offices, repair shops, coal grading shops, briquette factory, coke factory, the hospital and other establishments.

Hatou and Campha and other areas do not yet have improved roads, so that communications are poor.

On the other hand, going by sea, the scheduled steamers of about 200 tons can make two round-trips per day from Haiphong, requiring four hours for the trip to Hongay.

In general, though, the sea is shallow and there is the inconvenience of constant dredging of the sea bottom along the channel.

B. Topography

The topography in the Hongay area is governed by the geology there. The zone of palaeozoic limestone rocks presents an aged terrain due to weathering and is divided into innumerable hills - this being typical of the scenery of the Bay of Along.

Limestone rocks line the Bay of Along and its shores, forming outcroppings there and running along the northern part of Courbet Bay from east to west. These two zones running from east to west produce steep geographical features; and in the regions squeezed in between there are densely growing trees and small hilly areas - generally easy-rolling. The highest of the mountains do not exceed 400 meters above sea level. There are here coal measures belonging to the Triassic period of the Mesozoic era, with coal formations between sandstone, slate or conglomerate.

Because hilly topography squeezed in between the precipitous ancient limestone topography forms strong coal layers, the existence of the coal layers can be inferred from the topography.

C. Geology, Coal Layers and Coal Quantity

Geology

Because of arrangements with Hongay Mines, the present survey was only permitted a three-day inspection. Therefore, we apologize for the fact that the data is not sufficient to permit firm conclusions.

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The geology of the Hongay region has palaeozoic-strata coal as its base, and this is covered irregularly. Also, there are Triassic strata from the Mesozoic era. According to Mr. Rantona (phonetic transliteration) these belong to the Retchick (phonetic transliteration) system.

Coal strata intrude into the lower part of these Retchick strata. These coal measures may be divided into categories of upper, middle and lower strata.

Next, let usnshow the various categories of coal:

Lower coal measures: There are many layers of snadstone and conglomerate interposed with the coal layers; all of these strata together are believed to reach 500 meters of thickness.

Middle coal measures: Interposed conglomerate, sandstone and slate between varying thick and thin coal layers. Next to the coal layers is mostly hard slate, with some sandstone and conglomerate. The conglomerate for the most part is close to breccia in form. The cementing (binding matter) is quartz, forming extremely hard rock so that it is very hard to remove when digging the exposed coal layers.

Upper coal measures: Here are interposed layers of sandy shale, shale with thin layers of conglomerate, and ten coal seams (not very thick).

In the Hongay region there is no exposure of the lower partings becuase of incomformities or faults. And, in the main coal diggings of Campha, Hatou and Halam it is chiefly the middle coal measures that are being dug.

In the geological surveys up to the present time the upper coal measures were not clearly distinguished from the middle coal measures. The multiplicity of coal seams is believed to be a point that makes it difficult to look upon these middle measures as distinct.

In the region of Nagotna, Cay-da and Tambour, facing Courbet Bay, these upper coal measures are being worked.

Both the Triassic-period layers of coal and the limestone base rock run through the southern part of the Hatou pits area from Hongay Port, and continue northeast past the southern part of the Campha pits. These are believed to have been given their boundary by a great fault

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so that the lower coal measures' exposure in the form of outcroppings was produced as a result. The northerly limit of the coal measures is also deduced to have been brought into contact with the limestone base rock as the result of a fault running east and west.

The middle coal measures in the neighborhood of the pits of Hatou and Halam in the western part of the region and in the neighborhood of Campha show a very great degree of development. In the interveing region there have not yet been discovered any promising coal seams.

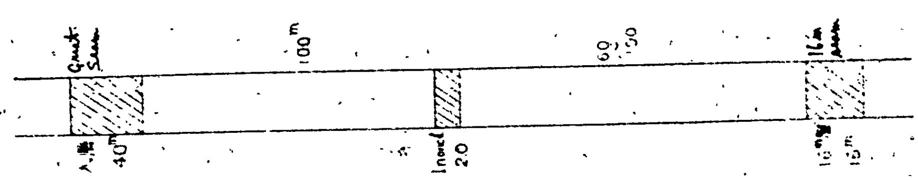
The strike of the strata in the Hatou and Halam regions is, in the main, north and south. Anticlines and synclines ~~occur~~ over and over so that the geological structure is extremely complicated.

Even when very steep, the pitch does not exceed 40% degrees, and in the Campha region the strike is generally east and west. In the northern part it is made up of strata with a simple slope of 20 to 30 degrees.

The upper coal measures are exposed from the Nagotna and Courbet Bay region through the Ngahi and Mong Dzuong region. The trend of the pitch is extremely variable and has no single fixed tendency. Even in Mong Dzuong there are many anticlines and synclines, causing much difficulty for sigging.

Coal Layers

The pits surveyed at the Hongay Coal Mines were the four pits of Hatou, Halam, Campha and Mong Dzuong. Since the other pits are presently idle, we will treat them with the general survey of the coal seams of the above-mentioned four pits. The Hatou pit is 13 kilometers east of the city of Hongay and borders on the east of Halam pit. There are three seams being worked. The order of these strata is as shown on the accompanying figure:



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In the main, the large seam is dug as an open-cut pit. Its thickness reaches 40 meters, but it widens and narrows irregularly, and because of the large amount of foreign matter the actual coal part is only from 10 to 20 meters. In carrying on open-cut digging, it is easy to exclude the foreign matter so that all the coal can be extracted. But, in pit digging it is difficult to dig the entire seam, so the rate of extraction is believed to be far lower. The condition of the part of the coal seam which can be seen at present in the individual open-cut diggings is shown in the accompanying table. That part which is of good qualityis in the upper and lower parts, while in the middle part there is thick slate rock of coal quality.

The Inonde (phonetic transliteration) seam is only dug from within the pit and is a 20-meter thick coal seam. Of this, the coal part is about 14 meters. And, though the foreign matter is not so large a proportion, near to the rock above and below the seam there is soft, coal-quality slate. Thus, in digging the coal, it is impossible to avoid an admixture of bad coal; and that smaller than Medium Lump grade has to be washed. Still, this coal seam has but relatively few turns and bends.

The 16-meter seam can only be reached from one point in the pit; and its condition, as shown in the figure, is such that in seven meters of shat there is only three meters of coal.

There is one part being worked by open-cut digging, but because of the many faults, there are no major outcroppings. In the future there should be development of pit digging.

Table of Coal Seams Being Worked

Area of Extraction	Seams Worked	Thickness of Seams (Meters)	Avg Thickness of Digging(mtr)	Digging Method
Halam	Large Seam (Grand Couche)	20 - 50	25	Open cut
	16-meter seam (16-meter Couche)	16	2	Pit
Hatou	Large Seam (Grand Couche)	20 - 60	24	Open cut
	16-meter seam (16-meter Couche)	16	2	Pit

Area of Extraction	Seams Worked	Thickness of Seams(Meters)	Avg Thickness of Digging(Mtr)	Digging Method
Campha	(Large Seam(Grand Couche)	80	30 - 50	Open cut
	(Upper seam(Couche au toit)			Open cut (Now idle)
Port Courbet and Nagotna	10-layer seam (10 Couches)	1 - 10		Small-scale open-cut and pit extraction now halted by labor disputes
Mong Dzuong	4-layer seam (4 Couches)	10 - 15	1.5 - 2.3	Pit digging

Halam Pit

Halam pit borders on Hatou pit on the west; the situation with respect to its seams is not greatly different from that of the Hatou pit.

The large seam is mostly dug by open-cut digging, with some pit digging. The coal seams have no fixed slope because of anticline and syncline axes, and the steepest slope reaches forty degrees.

There are three sites of open-cut digging along the large seam, running east and west. The changes in the course of the coal seam are as shown in Figure 1-A (Not included - Translator). The widening and narrowing of the seam is very marked and follows with the slope. In some hundred-odd meters the coal seam of thirty meters thickness decreases to four meters - an astonishing degree of change. And, even in the middle of the coal seam there is much crumbling of the coal. Thus, even when engaging in open-cut digging, it is difficult to employ any fixed method. Consequently, it is impossible to dig down below the water table; the various old open-cut diggings are almost solely above water level. It is rare for them to go down five meters below water level. Also, with a constantly rising and falling terrain, there is scarcely a single open-cut digging site where the strike continues for more than 300 meters.

The open-cut digging of the large seam at Halam pit seems already to be on the downgrade. Very large-scale equipment will be required if it is hoped to extract large amounts from the large seam in the future.

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As stated above, over the course of time - or even now - coal extraction from the rather thin Inonde seam, or from the 16-meter seam, by pit digging will become the main trend. The thick coal seam, on the other hand, obviously requires much effort to dig.

The Inonde seam and the 16-meter seam are only dug from the pit, though they arethin seams; and since the coal portions are well connected, digging conditions in the pit occasion little difficulty. The pit face of the Halam pit has the most favorable conditions of all the Hongay coal mines. The conditions of the coal seams - the above three seams - are as shown in the separate Figure.

Campha Pit

In the Campha pit only the large seam is dug as an open cut. The strike of the coal seam is north 50 degrees, and it forms a 25-degree slope on an east-west line. The area which constitutes the present open-cut diggings is the level of coal deposits at about 300 meters above sea level. Below this the coal is dug down no more than 25 meters. the pit faces are set at numerous steps along the strike about every 1300 meters. Digging is conducted through the difficult laboring of about 3,000 men per day. The deviations of the coal seam along the thousand and several-hundred meter strike are truly of astonishing frequency. At its western limit, the coal seam has turned almost entirely into slate. In the approximately eighty meters of thickness the five to ten meters of coal and coal-quality slate are divided into three different parts. But, the coal portion is very small; and farther on to the west even this finally gives out, and it is said that only slate is left.

From the middle area toward the east, the coal seam improves in quality; the slate gradually diminishes and the coal part increases. The measure of the coal seam is more than fifty meters. Of this, the coal part is divided into three parts - upper, middle and lower. Its thickness is twenty-four meters altogether. The part eastward from the present coal face already is the end of the outcropping diggings; and though it is not possible now to see the outcropping, the coal seam is becoming somewhat thinner and is like the seam which continues to the area of Le Mong Phelang (phonetic approximation - Translator). Above the large seam there is hard slate for about ten meters. Above that is breccia, which again is quite hard. In open-cut digging this slate and breccia is stripped off by steam shovels and drills. This is hauled off to more than a kilometer's distance away. And, when this rock above the coal and the foreign matter at the head of the coal seam is discarded, it amounts to six times as much foreign matter as coal. And, it is said that in the future there is a possibility that they will be digging one part of coal to ten parts of rock. But, if the proportion becomes as much as one to eight, this plus the expected wage increase will make it impossible to go on mining coal because of the cost factors. And, this may be the case when they are fifty meters farther down the seam from the present coal face, where it would be impossible to dig the deeper coal by open-cut mining. The situation with respect to the best part of the coal seams of the Campha pit, which can be ing mined only to about 20% of the total, is as shown in the separate figure.

Mong Dzuong Pit

Here the thickest layers of the four seams being worked are said to have a thickness of thirteen meters. As for the pit's sixth seam, believed to be the best, the part of the coal here which is mined is about two meters. In the space of these two meters there is a large zone containing pine coal near to the upper rock. Some difficulty accompanies the mining of this.

The coal is hard and of a fine, smokeless quality. Because of the synclines and anticlines running east and west in each coal seam, there is no fixed slope. Along the anticlines and synclines the coal is reached through great drifts. And, because of the many bends and turns in the coal seams is is not easy to tell how many coal seams there are. In the last analysis, it is believed that the surveys still have not been adequate enough.

The pits of Nghai and Nagatna are presently closde down and were not inspected on this survey. Their coal seams are numerous, but thin. We heard that they are dug with picks.

Coal quality

The quality of the coal at Hongay Coal Mines is all anthracite, with a low water content. The one to two percent of volatile components is high compared to anthracite in general; with seven to twelve percent solid carbon and seventy to ninety percent ash components, the components usually very skimpy are found in high proportion. Also, the 7,500 to 8,000 caloric value means that this must be called an excellent quality of coal.

Hongay coal, compared to that of Dong Trieu, has about ten percent soft, large lumps; and with small lumps and bean lumps included, the lumps come to forty percent, and the power coal to just about sixty percent. The results of the analysis commissioned to the Japan Coal Company, Ltd., are as shown in the separate tables of analysis.

Amount of Coal

Our survey was conducted in just three days' time, and the Tonkin Coal Mines authorities showed a high degree of secretiveness. Also, their charts to begin with did not show all the data. Thus, to learn the amount of coal underground, we surveyed the present workings of each pit and, according to our impressions, computed the approximate amount of coal about the site presently being worked. This process produced the breakdown shown in the table.

The coal underground amounts to about 355,000,000 tons; the amount which can be mined is 161,000,000 tons. The amount of coal underground at Hongay Coal Mines was previously said by the mining authorities to be 80,000,000,000 tons; and Japanese surveyors have suggested a figure of 1,000,000,000 tons plus. However, we do not believe that there is that much coal there. However, it is possible to surmise that the coal seams may extend on out into unexplored areas, and that after a careful survey the estimate of the amount of coal may be increased.

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Next, the twisted and tortuous condition of the coal seams is quite extreme so that it becomes even more necessary to give consideration to the actual yield rate. The rate given below may yet have to be scaled down, but it may be considered to be accurate.

Table of Probable Quantity of Coal at Hongay Mines

Pit Name	Name of Coal Seam	Thickness (meters)	Strike (meters)	Slope (meters)	Area of Seam (sq meters)	Specific gravity	Amt coal under-ground (tons)	Rate of yield	Amount Mineable
Hatou	(Large-seam ((open-cut)	15	600	400	240,000	1.5	5,400,000	80%	452,000
	(Large-seam ((pit-mined)	5			4,000,000	"	30,000,000	50	15,000,000
	(Inonde seam	1.3			4,000,000	"	7,800,000	"	3,900,000
	(16-meter sm	2			4,000,000	"	12,000,000	"	6,000,000
	(TOTAL						55,200,000	"	29,220,000
Halam	(Large-seam ((open-cut)	10	1,000	100	10,000	"	1,500,000	"	1,200,000
	(Large seam ((pit-mined)	5			8,000,000	"	60,000,000	"	30,000,000
	(Inonde seam	1.3			9,000,000	"	17,550,000	"	8,000,000
	(16-meter sm	2			9,000,000	"	27,000,000	"	13,500,000
	(TOTAL						106,050,000	"	53,500,000
			Sub-totals				161,250,000		82,720,000
Campha	(Large seam ((open-cut)	24	1,000	100	100,000	1.5	3,600,000	80	2,880,000
	(Large seam ((pit-mined)	8	3,000	1,000	3,000,000	"	36,000,000	50	18,000,000
	(TOTAL						39,600,000		20,880,000
Mong-Dzuong	4-layer coal seam	6	3,000	2,000	6,000,000	"	54,000,000	50	27,000,000
Nagotna, Nghai & Courbet	(Multiple thin (seams: given (for vicinity (of outcroppings		(estimated) coal content				100,000,000	30	30,000,000
			GRAND TOTAL				354,850,000		160,800,000

ROUGH-DRAFT

Excerpts from Reports of the French Indo-China Resources Survey Group; Section I, Volume 1: Mineral Resources

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PART I

COAL

COAL

(All French Indo-China)

Period of Survey   January - March, 1942

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Survey Schedule	Area of Survey
January 11 - 20, 1942	Hon Gay coal fields, coastal mines at Port Courbet
January 26-February 2	Dong Trieu coal fields
February 9 - 11	Tuyen Quang and Phan-me mines
February 19-March 4	Tourane coal fields and South Indo-China area
March 6 - 7	Phan-me Mines and Phu-Nho-Quan coal fields

[* All Japanese names will be rendered with given name first and family name second - in the Occidental manner. - Translator]

Chapter 1 An Outline of the Coal-mining Industry

Section 1 The history of coal mining and mining administration

The coal mining industry in French Indo-China is located in the "Basin de Quang-yen", which includes the Bay of Along, where most of the development has taken place. Thus, it is superfluous to say that the fine quality of the coal, its abundance and the convenience of communications and transportation in the area were the prime motive factors behind France's political seizure of this area.

Before the period of France's take-over of the state of Tonkin in 1880, the Chinese had been moving ahead with small-scale development of the coal resources of this area. Putting into effect its colonial policies, France immediately gave attention to the coal fields in the Bay of Along area. Yet, although the French pursued the development of these underground resources, the project at first got under way slwoly because of limitations of the markets. But, later the French policy for development of the Indo-Chinese coal fields called for more and more rapid progress, and survey teams were despatched a number of times to cause the project to be carried forward to realization. And, finally in 1888 the Hon Gay mineral region was purchased and the Tonkin Coal Mining Company (Societe Francaise des Charbonnages du Tonkin) was organized. This company, though suffered many hardships and reverses, and it was not until the year 1900 that they were finally in a condition to be able to show a profit.

Also, in 1916 - during the First World War - the Societe Charbonnages du Dong-Trieu was set up to develop the northern part of the Bassin de Quang-yen, which runs along the course of the Song-Da-Bach. Since then, these two great coal mines in French Indo-China have been Exploited with whole-hearted endeavor. Even during the First World War, despite inflated freightage rates and the perils of sea transport, the industry rode the wave of rising coal prices and progressed steadily. So, the French intrepreneurs warmed up to the mining industry of Indo-China, and one after the other the coal-mining companies Societe Francaise des Charbonnages d'Along et Dong-dang and the Societe Anonyme des Charbonnages de Tuyen-gong came into being. And, now they have come to control the whole coal-mining industry here. Consequently, the two great coal mines of Hong Gay and Dong-Trieu constitute the two main parts of coal mining in French Indo-China and control this field of activity. They produce more than 90% of all the coal mined in French Indo-China. Finally, even with respect to their capitalization - as shown on the classified chart - they have 77% of the activity, or 128,064,000 francs.

Thus, through these enterprises France derives great profits an a great service is performed for the motherland.

Company Name	Founded	Current Capital-in 1000's francs	Remarks
Tonkin Coal-mining Company	1888	100,064	Anonymous Co.
Dong-Trieu Coal-Mining Co.	1916	28,000	" "
Along Dong-dang Mining Co.	1927	11,000	" "
French Indo-China Coal and Metals Mining Company	1924	20,000	" "
Tuyen Quang Coal-Mining Co.	1924	8,000	" "
Phu Tou Coal-Mining Company	1938	100	" "
Bao Ha Coal-Mining Company	1939	350	Limited Liability Anonymous Company
	TOTAL	167,514	

France's colonial policies toward French Indo-China differ from those of Holland and Britain in being completely centered on the mother country. Thus, the economic development of the colony is subordinated to, and tied into the economic structure of the mother country. So, the progressive development of French Indo-China itself is sacrificed, and of course the foreign capital does not benefit the native peoples. There is no intention of planning the

3. Extracting Coal

a. Halam Pit

Although only 4.5 kilometers to the east of Port Hongay, Hatou is serviced by a railroad detouring to Hatou over a 16-kilometer course. (The old railraod going direct to Halam from Hongay is not now in use.)

The grande couche (large seam) is worked by open-cut mining just as in the other areas, and its three terraces are each five meters high. All of the terraces are dug on an angle of no more than 45 degrees. Though the coal seam is 20 to 50 meters thick, according to its location, not all of the seam coal can be mined. With very bad bending and turning, the good coal is mined selectively in either the upper or lower part. (In some places the poor coal parts turn into seams of coal-quality slate.)

As the coal face is moved along, the top soil is stripped off. At present in the various areas about 60% of the top soil has been removed. First, the top soil is hauled in mine cars to the site of old open-cut diggings, and then dumped.

Although as much of the drainage as possible is allowed to run off naturally through drainage ditches and culverts, pumps are used where this is not possible.

Coal picks and rock drills powered by compressed air are used in the mining, and loading into the coal cars is handled by shovels. (Translators note: The Japanese text uses phonetics for "shovels" - possibly steam shovels.)

Mining in the pit is conducted through horizontal and sloping shafts in the 16-meter seam. The thickness of the mining on the coal face is about 20 meters, with 4.5 to 6.0 meters of good coal. And, for 120 meters along the slope of the seam the method used is the "lateral-thrust long-wall system" of digging coal.

The miners work the coal face with a spacing of two men for every three meters; and for every meter of height they cut two meters of width. Every time they move forward one meter they cut the seam to shoulder height; and they cut the coal face along one straight line.

Support of the cleared area depends on vertical beams and ceiling beams. For mining the coal, coal picks are used; and the coal is moved away from the face being cleared by running it down a sloping steel pipe. (The coal seam's slope is 20 to 25 degrees.)

The crew (e.g. for 120 meter-hours on the coal face:

Coal diggers	30
Assistants	15 - 20
Conveyers	10
Supervisors (Chinese & Annamese)	7 - 10
TOTAL	120 - 112 (sic)
Extracted coal	90 - 120 coal cars (1 car equals ½ ton)

Extractive efficiency then is very unsatisfactory.

Though the workers move at a furious rate, because of their unsatisfactory rate, the workshops are constantly troubled by the inefficiency of their crews, over and above the unsatisfactory characteristics of the miners. Not only are they unable to produce the required amount of coal, but in moving the coal face forward just one meter, they have difficulties from three or four other sources and thus have great difficulty in keeping up the work.

Drainage - At present drainage is run out naturally from the pit through horizontal drainage ditches.

2. Hatou Pit

Located at a point 12 kilometers eats of Port Hongay.

Just as at Halam, the great seam is mined by open cuts, here in two places. The thickness of the part mined is about 25 meters; and there are terraces in nine steps. In addition, it is managed in much the same way as Halam.

The coal seam mined from the pit is the 1.6 meter seam.

The depth is much greater than at Halam; it is a great pit called Simmon Puit.

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Simmon Puit

The pit is finished in round concrete 3.50 meters in diameter and is 115 meters deep. Itnis equipped with a 150 h.p. electric hoist.

The mining methods are the same as at Halam, but the length of the coal face, including the vertical distance between the shaft bottom and the middle-step gallery, less the 50-meter slope of the coal seam, is 150 meters. (The slope is 30 degrees.) This is 30 meters longer than Halam.

These facts, together with the staffing shortage at the present works, causes difficulties in maintaining progress on the coal face. Still, the coal can be moved out through the steel pipes and into the open where it is hoisted up by windlass to the large coal cars and sent to the storage area.

In normal times water collects in the pit at a rate of 200 cubic meters per hour, but in the wet season the rate reaches 600 cubic meters. Used against this are the pumps:

2 150-h.p. pumps in the middle level of the shaft (65 meters down from the pit mouth)

1 150-h.p. pump at the shaft bottom (115 meters down from the pit mouth)

1 50-h.p. machine - same location

1 20-h.p. machine - same location

Total equipment - 5 machines

The ventilation system, too, is extremely haphazard. There is one ventilator fan with a capacity of 25 cubic meters per second set at the head of the pit. Not only is the exhaust system's ventilation defective, but there is serious damage from the humidity of the air. The air ducts have a narrow cross-section. Except for the main conveyance shafts and the ventilator shafts with their fans, there is but a very small amount of air, and the miners at the coal face suffer from the high temperatures, but are not permitted to strip while working.

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3. Campha Pit

At present, the largest of all the pits in the Hongay region is the Campha Pit, 8 kilometers west of Port Campha along the railway.

Earlier, just a part of the pit was being worked, but now it is the largest-scale open-cut mine in French Indo-China, with the great seam being mined for a distance of 1.3 kilometers. The overall thickness is 80 meters; but because of the bends and turns there are not a few places where conditions are unfavorable. Still, this is good quality coal, and it is actually being mined to a thickness of 30 meters.

The terraces of the coal-seam portions of the open pit number 9 to 12 steps, and if the parts stripped off from ground level are added in, they number more than 25 terraces.

Here the overlying rock is drilled with air-pressure powered rock drills and broken up. The pulverized rock is loaded into coal cars by three steam-powered shovels and one electric-powered shovel and hauled by steam locomotive to the waste-rock dumping grounds.

The mining of the coal is mostly done by miners' picks and hand drills.

The coal is loaded into coal cars by hand and rolled down to the lowest point from the nearest of the three locations where there are inclined tracks. Thence it goes by aerial electric cable car to the large coal cars for transporting to the coal storage bins (capacity 2,000 tons).

4. The Port Courbet and Nagotna Area

Here coal was mined from 1 up to 10 meters high from seams 10 meters thick, both open-cut and pit mining being employed. This was earlier carried on in many places on a small scale, but the mines are now idle.

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5. Mong-Dzuong Pit

This is 7.0 kilometers north of Port Campha. There is no pit mining. There are eight coal seams, but only four of them are mined, these being 11.0 meters, 2.5 - 3.0 meters, 6.5 - 7.0 meters and 2.5 meters in thickness; but the fine qualityycoal is mined fromaa total of about 2.0 meters of all of the seams.

Concrete-lined shafts have been excavated for the mining of the coal - diameter 4.5 meters, length 100 meters. There are two 290-h.p. hoist motors for raising and lowering the loaded deck cages. By means of this equipment the coal dug from each seam by the side-thrust (lateral thrust), long-wall methhd is lifted from down in the shaft and from each seam.

The middle-level gallery following the seam 50 meters above the shaft's water level has no direct connection with the coal-car conveyance system, so that for transporting the coal the pit bottom is the onyl terminal.

At Mong-Dzuong the coal seams being mined are large so that the digging of one seam has a bad effect on the other seams. Therefore rock and sand from the mine dumps must be brought in from outside and packed into the finished galleries.

First, mats are woven of the bamboo which grows on the nearby hills. These are then set up about 1.5 meters from the cleared face, and dirt and sand are sent down a diagonal shaft from outside; and the gallery is gradually filled up.

This plugging up takes up almost as much time as the mining itself, so that actually, the mining of each location takes twice as long.

Because of the gas, lighting in the pit is provided by electric hand lanterns.

In the pits the main ventilation is by ventilating fans (capacity 20 cubic meters/second); but since the percentage of gas in the exhausted air is 1.6%, there is still need for looking into ways of improving the ventilation system.

Though the usual rate of water seepage into the pit is 240 cubic meters/hour, in the rainy season this rate is said to reach 600 cubic meters per hour. Therefore, these are set up at the pit bottom and in the middle section the following:

In the middle section	4 50-h.p. pumps
In the pit bottom	2 100-h.p. pumps
" " " "	2 50-h.p. pumps

A total of eight electric pumps (including reserve equipment) are, then, used for emptying out the seepage.

Coal-Grading Machines

There are coal-grading machines both at Port Honagy and at Port Campha. The coal extracted to the west at Halam and Hatou and the coal extracted to the east at Campha and Mong-Dzuong is handled at Campha.

At the Hongay coal-grading shop there are four large and small vibrating sieve separator machines with a total capacity of 220 tons per hour. And, there are 12 small Bac & Piston type water-dresser machines.

The natural coal is first separated in the sieve-separator into lump coal - more than 50 mm,/medium lump coal coal - 50-30 mm, (words missing-Translator) - less than 30 mm. Above 30 mm the foreign matter is sorted out by hand; under 30 mm the water dresser is used.

The refined coal coming out of the water dresser is divided into six grades: washed small lump coal - 30-15 mm; washed, very small lump coal - 10-15 mm; washed pea-lump coal - 6-10 mm; washed special powder coal - 3-10 mm; medium powder coal - 0-30 mm; and fine powder coal - 0-10 mm.

The Campha coal-sorting shop is set up separate from the west coal depot at the Port Campha coal dock and is equipped with two Humboldt and Evence-Coppee sieve separators with a total capacity of 500 tons/hour, and with three Jigger type water dressers. The grading is the same as at Hongay.

As it is the general practice to mine only good-quality coal, the coal sorter mainly has only to sort the coal by size. Similarly, the water dresser does not have too difficult a job either in separating by hardness.

The grades of coal running from lump to powder have an increasing ash content, and the solid carbon also decreases in proportion.

Thus:

	Water Content	Volatile Portion	Solid Carbon	Ash Content
Lump Coal	1.5 %	7 - 10 %	86 - 90 %	0.9 - 1.3 %
Med. Lump	1.0	6 - 7	74 - 86	6.0 - 12.0
Dressed Powder	5.0	10 - 12	69 - 80	8.0 - 14.0

4. Transport

For taking coal from the mines, there are locomotives running on 0.6 meter track of a loaf capacity of 9 - 12 tons per meter, pulling steel coal cars of 0.5 tons capacity; and there are also the overhead windlasses by which the coal is taken to the large coal freight cars and, in these, to the coal-storage depots.

The coal is unloaded at the coal depot from drop-bottom coal cars of 10-ton capacity. In the Halam and Hatou region the coal is sent to the coal-grading shop by steam locomotive; in the Campha and Mong-Dzuong region electric locomotives with overhead cables are used to haul the coal to the coal-grading shop. The gauge of this railway is 1.0 meter, and the rails have a load capacity of 22.5 tons per meter.

	Hongay	Campha
Kind & No. of locomotives	25 steam locomotives of 10 - 33 tons	5 locomotives with 4 110-h.p. electric motors of 110 volts
No. of Cars per trip	10 - 20	30
No. of freight cars	300	250

The freight cars which haul the refined coal from the grading shops to the storage depots, or from the storage depots to the docks, are 4-ton capacity side-drop cars (each car weighing 3 tons) with a coal box made to be picked up loaded by the cranes at the storage depots or docks and emptied.

5. Port Storage Depots & their Equipment

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Storage Depots

At Port Hongay the area is very narrow, so that there is not much room for storing coal. But, when it has to be stored, it is stored as raw coal right at the mines.

At Port Campha there is a large coal-storage depot measuring 700 meters long and having a capacity of about 500,000 tons of coal; it is located between the coal-grading machines and the coal-loading wharves. At the time of the survey there was about 300,000 tons of coal stored there.

Here there are three overhead cranes with a reach of 40 meters. They are electrically powered and can lift the 4-ton coal boxes and release the coal at any point by lifting the drop-side. Or, they can load the coal from piles by means of a coal grab.

Equipment of the Ports

As for the ports belonging to the Hongay Coal Mining Company there are, from noth to south, the ports of Wallut, Campha and Hongay. The latter two load Hongay coal, and the other loads Kebao coal.

1. Port Hongay

Port Hongay was opened in 1890 and is located at the entrance to Port Courbet on the north part of the Bay of Along. It has three wharves. The details are as follows:

Name	Location	Construction	Pier Length	Water Depth (Low tide)	Equipment
1st Wharf	Middle	Brick	70 meters	3.0 meters	3 Guillard-type steam cranes, 1 electric crane(a)
2nd Wharf	NW Bank	Brick	80 meters	8.0 meters	-
3rd Wharf	SE Bank	Steel-reinforced concrete	75 meters	7.0 meters	2 Morca (PHONETIC) type hydraulic cranes (capacity 9 tons/hour) (b)

(a) Used previously to load coal from shore into lighters at inner Hongay.

(b) Capable of loading ships of 4,000 to 6,000 tons dwt.

Also, in addition to these, there is a floating crane of 60 tons/hour capacity; and in inner Hongay there is a small wharf for unloading Hongay coal.

The docks are completely equipped and may be said to have a large loading capacity. But, there is not much level ground at the port, and the storage area is small, so that the export of refined coal is actually controlled by the capacity of the grading machine. The actual loading capacity, then, must be said to be very greatly restricted.

Thus, large ships of more than 6,000 tons burthen go to Port Hongay. The loading capacity (at Port Hongay) is 1,500 to 2,000 tons per day, working a 20-hour day.

2. Port Campha

Port Campha was opened up much later than Port Hongay and is 40 kilometers distant from Port Hongay. It loads anthracite from the pits of Campha, Mong-Dzuong and Rayomnd Ferrant. The distances from Campha pit and Mong-Dzuong pit are respectively about 8.1 kilometers and 7.0 kilometers. There is a 30-ton electric locomotive (110-h.p. 750-volt DC motor, capable of pulling 300 tons at 34 kilometers/hour). The wharf is 300 meters long and made of steel-reinforced concrete. There are 4 moveable overhead cranes, each having a capacity of 120 tons/hour. They move the 4-ton coal boxes and can load them directly into the ore boats. There are also three electric overhead cranes with a total loading capacity of 12 hours/day and 5,760 tons. When loading a ship in the offing 700 tons/day is usual. The depth of water at Port Campha at low tide is 9 meters, so that it can take considerably larger ships than can Port Hongay. Thus, the port can handle a ship of 8,000 - 10,000 tons and at the same time two ships of 5,000 - 6,000 tons - for a total of three.

3. Port Wallut

This port is located 8.7 kilometers from Hongay on the north-east shore of Kebao Island. As Kebao pit is idle at present, this port is hust a port of call for the scheduled steamer from Port Hongay to Moncay.

The depth of water is 8.0 meters; the whard is 60 meters long, and there is one 60-ton/hour capacity Guillard-type crane. The briquette factory and coke factory border upon the east and west sides of the Hongay coal-grading shops. And, to get the details of the production ecpenses of the factory equipment, please see the article on briquette and coke in Chapter I Section 6.

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The Central Steam-power Plants

The source of power for the mining company is the steam-power plant built at a place five kilometers east of Port Hongay. The plant has four 1000KW and one 4000KW turbo-alternators (Societe Alsacienne de Construction Mecaniques) and six Babcock and Wilcox boilers for providing steam (equipped with superheaters and automatic revolving grates, each with heating surfaces of 215 square meters).

While these have a total capacity of 8000KW of power, usually the one 4000KW machine is operating, and the others are held in reserve. The current generators have an electrical pressure of 3000V, but to send current to the mines the current is stepped up to 30,000V; and at the other end the pressure is stepped down by a transformer station to 3000V again and supplied as the power source for all kinds of equipment. For power at the mining company and for illumination the power is used at a fixed pressure of 110V.

As the power source for the electric locomotives, there are transformer stations set up at Campha pit, Port Campha and Mong-Dzuong, supplying 750V DC current.

Machine Shops and other Installations

Near to Port Hongay there have been completed an iron works (forging, casting and finishing), a wood shop and an electric shop. These are staffed by many skilled French workmen - the core of the crew - and Chinese and native workers; and they do special building and repair. Further, besides these there are small repair shops at each pit.

Numbers of Miners and Wages

Laborers are being recruited through most strenuous efforts, but of late the numbers are decreasing; i.e.:

End of 1938	End of 1939	End of 1940
27,338 men	25,965 men	24,566 men

As a counter-measure to this, women and youths are being employed, though they are barred from mining in the pits as much as possible. Main attention is given to open-cut mining so as to maintain the rate of coal extraction.

Next, to look at a breakdown of the laborers by age and sex:

	1939	1940
Adult males	84.2%	72.4%
Adult females	13.6	20.2
Youths and Children	2.2	7.4
TOTAL	100.0	100.0

This shows the sharp increase in the rate of employment of youths and females.

The miners' wages are slightly different in the pit and outside the pit:

Adult miners outside the pit	0.42 - 0.45 piasters
Adult miners in the pit	0.55 - 0.65 piasters

Wages of women and children are respectively 0.03 and 0.06 piasters less than these standard wages.

Besides this, rice is sold to working miners at one-fourth the prevailing price. The payment of wages takes place three times a month on the 10th, 20th and 30th.

Welfare Facilities

The Tonkin Coal Mining Company, the largest coal mining company in French Indo-China, gives attention to the reform of the workers' daily living, to their health and to their education. It provides housing, a hospital, playgrounds, churches, a water supply and sewage facilities. But, none of these are set up from the standpoint of the positive protection of labor; just as before there is unfeeling, cold treatment of the natives.

Housing - Groups of laborers' dwelling houses have been constructed near to the main coal pits. They are equipped with electric lights, running water and sewage facilities. But, compared to the magnificence of those for the French, they are as different as heaven and earth.

Hospitals - Both Hongay and Campha have hospitals. French doctors and Annamese assistants are always on duty and giving treatment. It is said that the Hongay hospital has a capacity of 180 patients.

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Schools - There are five schools directly supervised by the company and giving, in general, education of the primary level. In Hongay and Katof (Phonetic transliteration) the French children are educated, but no high-school education is carried on.

As a counter-measure to the recent increasingly unsatisfactory working efficiency of the workers, the Tonkin Coal Mining Company's affiliated workers' supervisory school has been set up. By 1940, the first-term class had reached thrity in number. It plans the raising of the natives' technical skills; but because of the natives' disinterest for learning, it does not seem that the hoped-for goals will be achieved.

As a counter-measure against rising prices of goods and to maintain the supply of the natives' rice, the company is selling rice at bargain rates. For those actually working, 1.2 kg of rice per person per day is supplied at a rate of 0.06 piasters - against the prevailing price of 0.24 piasters. This is both an incentive to work and a supplement to the wages. For daily necessities other than rice, the company maintains no separate store, but has the workers make their purchases on their own from Chinese merchants and native-quarter merchants in the towns.

6. Kebao Pit

The whole island of Kebao, which lies to the east of the Hongay mines, is a mining area. Its area is broader than the Hongay region, and the coal reserves are said to amount to 200,000,000 tons. But, in the past the planning of the managers was inadequate, and the mine was temporarily abandoned. But, later on, it went through a period of reckless exploitation under the capital of the overseas Chinese, and then came under the management of the Tonkin Coal Mining Company, its present-day management. However, the coal seams and coal quality are inferior to those of the Hongay region. And, with many difficulties attendent to the mining, even though the port is located conveniently nearby, the results were unsatisfactory; and since 1941 the mines have been idle. (Since our survey of this coal was postponed, we are unable to relate any of the details.)

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The Tonkin Coal Mining Company's total coal extraction for the past ten years is as follows:

UNIT: 1000 TONS

	1931	1932	1933	1934	1935	1936	1937	1938	1939	1940	
HALAM	175	158	128	95	75	265	314	363	480	454	3,184
HATOU	150	163	116	132	116						
CAMPHA	290	265	278	319	399	478	591	532	597	571	4,320
RAYMOND FERRAND	133	106	--	--	--	--	--	--	--	--	--
PORT COURBET & NAGOTNA	151	133	89	62	32	75	114	144	142	139	1,081
MONG-DZUONG	248	291	305	312	335	489	463	435	394	366	3,638
MAS-KHE	169	105	76	60	73	133	130	140	148	165	1,199
KEBAO	81	84	80	35	30	25	27	27	26	20	441
TOTAL	1,397	1,305	1,078	1,015	1,060	1,465	1,639	1,641	1,787	1,715	14,102

Section 2 The Dong Trieu Coal Mining Company

(Societe Charbonnages du Dong Trieu: SCDT)

1. History

In 1900 the existence of coal seams in the Dong-Trieu mountain ranges was discovered by Major M. Gilmann, commander of the Uong-bi garrison army. Later the Haiphong businessman M. Faussemagne staked a mining claim there on the basis of Major Gilmann's report and got control of the Clothide Louise. Later he acquired the Francoise mining region.

Another businessman, M. Tlambeau (sic) became the owner of M. Faussemagne's mining area in 1905-1906; and he annexed the Berthe mining area, which is to the south of the above-mentioned two areas.

Finally, in 1910 a third businessman, M. de Redoo de Colombier, purchased the three mining areas and, after an on-the-spot survey, obtained permission to sink a mine. He began building roads and received approval for future development rights for the known coal seams. Thus, he began to try to mine these already known seams and set up a limited liability company (stock company). But, because of various difficulties accompanying these activities, and because of World War I, the project was interrupted. Later, the Dong Trieu Coal Mining Company was set up on April 18, 1916.

Unit: 1000 tons (單位 千噸)

	1931年	1932年	1933年	1934年	1935年	1936年	1937年	1938年	1939年	1940年	合計
Halau	175	158	128	95	78	265	314	363	480	454	3,184
Hatou	150	163	116	132	116						
Campha	290	[illegible]	278	819	599	478	591	532	597	571	4,820
Raymond Ferrand	183	106	—	—	—	—	—	—	—	—	—
Port Courbet & Nagotna	151	138	89	62	38	75	114	144	142	139	1,081
Mong-Duong	248	291	305	312	335	489	463	435	394	366	3,638
Mao-Khé	169	105	76	60	73	133	130	140	148	165	1,199
Kebao	81	84	66	38	30	25	27	27	26	20	441
合 TOTAL 計	1,397	1,308	1,078	1,016	1,060	1,465	1,639	1,641	1,787	1,715	14,102

Established	April, 1916
Capitalization	60,000,000 francs
Home Company	5 Rue Blanche, Paris
Branch Company (Sales)	Comptoir des Charbonnages Indo-Chinois, 10 Boulevard Bounal, Haiphong
Coal Mine Offices	Uong-bi (Province de Quang-yen, Tonkin)
Purpose of Company's Management	Development of mines and related activities

Breakdown of capitalization increases:

1920	5,000,000 francs
1922	8,000,000 francs
1927	28,000,000 francs
1940	42,000,000 francs
1941	60,000,000 francs

Mining Regions and Areas

		Area
Operating mines	Clotilde Louise	2,400
Idle mines	Adrien	1,100
	Ferdinand	1,247
	Berthe	2,000
	Espoir	2,400
	Saladin	1,860
	Francoise (one section working)	2,400
	Pierre	494
	Desespoir	2,292
	Helene (one section working)	50
	Willy	732
	Hasard	900
	Therese	2,540
	TOTAL	20,415

Mine supervisor: Albert Lataste

2. Location, Communications, Topography

The mountain range (commonly called Dong Trieu south range) here runs east and west to the north of the Bisho and Mao Cay coal mines mentioned earlier and is roughly parallel to them. To the north there is another range (commonly called Dong Trieu north range). The highest peak is over 1,000 meters above sea level, showing the youthfulness of the topography here. These ranges contain middle and upper coal measures; and it is possible to deduce that there is a syncline axis running east and west down the center of the range.

In the middle of both the Dong Trieu north and Dong Trieu south ranges there is a valley running east and west. On the south side of this valley there is a fault running east and west. And, on the north side of this valley there are palaeozoic era strata, or strata of the lower Triassic period. Covering these, the lower coal measures run east and west and are exposed on the mountainside as outcroppppings. Near to the eastern end of these outcroppings is the Clotilde Louise mine of the Dong Trieu Coal Mines. This is one of the so-called Dong Trieu Mines.

There are offices at the town of Uong-bi on the flatland; and there are the water-dressing shop, the power station and the repair shops, which are reached from the mine by a simple and convenient railway of about eleven kilometers length. And, the loading dock and porthead of Port Redon is just six kilometers away.

Near to the pit entrance there are precipitous hills; the pit entrance is 100 meters above sea level.

Uong-bi is along the surfaced highway between Hongay and Hanoi. It is possible to reach Haiphong by car in about one and one half hours. And, as for the port - Port Redon - six kilometers south of the town, it has a sounding of seven meters at low tide. Ships can easily enter the port, but since no pier has been constructed yet, loading must be via lighters. But, compared to the situation at some of the other smaller coal mines, it is far more convenient.

3. Geology and Coal Seams

The coal measures which crop out along an east-west axis on the middle flank of the north Dong Trieu range are quite different from those on the south range - i.e., those of the Chacha and Mao Cay mines - when considered from the standpoint of the relative positions of the rock and coal seams. And, they are believed to belong to the middle or upper coal measures. These coal measures are directly covered by lower Triassic strata, or Palaeozoic limestone strata. But, it is felt that because of faults or nonconformity, the outcroppings of the lower coal measures are non-harmonious with the restsof the strata.

The coal measures of the Dong Trieu north range are being worked in the Clotilde Louise region and are paralleled by strata of sandy slate, sandstone and breccia. Between these strata are ten seams of coal.

Of these, the ones being worked are the second through the sixth seams from the bottom - five seams in all. These seams have relatively few bends and turns. In the east part of the mining area the strike is approximately east and west; to the north they have a slope of around twenty degrees, but toward the middle this becomes forty degrees. In the west sector the strike runs north and west because of faults. In the north-east it shows a slope of twenty degrees. And, coming to the western end, the strike again shifts, this time to north and south because of faults. In the north-west the gradient is twenty-five degrees. The above structure is the result of three parallel faults running from north-east to south-west.

The coal measures are partly affected by these faults, but in general they have an east-west strike and slope to the north, with continuous outcroppings in both the east and west.

The east part of the mining area is still under the protection of the French Indo-Chinese government and is not open, so that no mining has been started here yet. To the west there are the Francoise and Therese mining areas, which were established before the reserve was set up; all are said to be affiliated with Dong Trieu Coal Mines.

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Existence of coal seams in both areas has been confirmed; and itiis believed that in the future mining must be developed here. It is expected that the conditions of the seams is quite superior.

These coal measures are on the north side of the Dong Trieu Coal Mines, and in their deeper parts there is a syncline axis running east and west. They have a gradient to the south. Thus, the amount of coal which can be mined increases.

Though there are ten seams here, those which can be worked are the second through the sixth seams from the bottom. The second seam is just barely two meters thick; it is enclosed top and bottom by coal-quality slate. But, the coal itself is of excellent quality.

The third seam is three meters thick and is said to contain a large amount of iron-sulfide ore.

The fourth seam is partly worked in the Francoise region, and the mined coal is one meter thick.

The fifth seam is 1.3 to 1.6 meters thick and is comparatively free of bends and turns. The middle part occurs between coal-quality slate and banded coal.

The sixth seam is the thickest of all the seams - 2.5 meters - and is relatively wide, with good quality coal.

Of the above five seams, the second and sixth seams are the best; and most of the coal extracted comes from these two seams.

In the coal mine almost at the center of the Clotilde Louise mining area there is excavated a great cross-cut shaft which leads to the coal of each seam. On both sides lateral access shafts runs out. And, in the main shaft there is set up a windlass for hauling out the coal. This enables the shafts to run out for three kilometers.

At present, most of the mining is above the water table; and shafts are being dug in the fifth through eighth seams. Rotary pumps keep the water level down both inside and outside the pit. The distance from the main pit enrance to the grading machine is just about 600 meters, so that transporting the coal is quite simple and convenient.

Below the water table, one part of the second seam is pierced by a sloping shaft (25-degree slope at about 200 meters. And, equipment for mining the coal is being set up while the search for coal below the water level goes on.

4. Quality of Coal

As shown by the results of analysis, the coal at this mine has a relatively high water content, and the volatile elements are in very low proportion. Thus, if the fine coal is specially sorted by hand, it is possible to obtain coal for use in making electrodes. Also, as a hard coal it is good for transportation uses. Great care is taken to eliminate powder coal so that the rate of lump coal is very high. Finally, it is the best kind of coal for the carbide industry.

5. Amount of Coal

The area presently being worked (parts of the Clotilde Louise and Francoise mining areas) follows the strike for about three kilometers; and the coal seams have been confirmed as stretching on to the east so that it is known that the strike extends for five kilometers. Since there is an area along the strike that can be mined for 1,000 meters, the area of the coal seams is about 5,000,000 square meters. And, if the total thickness of the coal in the seams that are worked is given as seven meters and the specific gravity of the coal is 1.5, we derive a total coal reserve of about 52,500,000 tons.

Now, considering the whole western part of the Francoise mining area, we again get about the same amount of coal reserves, so that in both the Clotilde Louise and Francoise mining areas the amount is believed to reach 100,000,000 tons. The coal measures form synclines, so that if the ups and downs are included the amount of coal must be even greater. Since there are comparatively few bends in the coal seams, the mineable portion must be comparatively better than at the Hongay Coal Mines. Thus, we arecoming to feel that this coal mine has excellent possibilities for the future.

6. Mining the Coal

Today, mining of the above-noted second to sixth seams begins with the drilling of the vertical entrance shaft north of the right bank of the Uong-bi River; and the mining in the pit is carried out above the water level upon reaching the seams. The position of the cross-cut is 70 meters above ~~water~~ sea level; the average level at which the mining takes place is 250 meters above sea level.

The right-hand side of the easterly, or cross-cut shaft is the main shaft following the number-four seam. It has already progressed about 3,700 meters. On the west, or left side there extends the main shaft in the sixth seam. In the part where the strike bends to the north-south line the direction of the shaft does not change, but extends on into the rock and gradually reaches the fifth, fourth, third and second coal seams, so that mining can be carried out in each seam.

The right-hand part has small cross-cut shafts running into the main shaft in the fourth seam every 400 meters. The middle shaft runs horizontally for about 100 meters. In addition to the three shafts 175 meters, 275 meters and 375 meters from the surface, there are small shafts with separate connections to the surface, used when the earth and gravel are filled into the mined seams.

Mining is carried out by the long-wall, lateral-thrust method, with small cross-cut shafts running into the main transport shafts every 400 meters. And, after completion of the mining of each 400-meter section that part of the shaft is abandoned.

The fifth and sixth seams, being thick seams, are worked from two terraces. First, they mine the lower terrace, and then woven bamboo mats are set up and sand and gravel from outside the pit is filled in behind; the working of the upper terrace follows along about six meters after the lower terrace face. There is no filling in of the second terrace. The coal extracted from the pit is collected in a cross-cut shaft seventy meters from ground level; that from the middle-level shaft is dropped to a lower level along the automotive sloping track. Where necessary, part of the coal is brought out by hand-push carts from the middle shafts to the surface and sent to the coal-grading shops along with the coal brought out by the other methods.

Coal extracted in the above way is all mined from the pits above the water level; but since 1941, in the left-hand part of the great cross-cut they have developed a sloping shaft down to the second seam and have already pushed it along 200 meters.

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In the mining, coal picks and rock drills powered by compressed air are used; and insofar as possible they are seeking to increase the efficiency and labor economy of the crews.

The total length of the important shafts is about twenty-five kilometers:

Concrete-braced	1 kilometer
Bare rock	3 "
With steel supports	19 "
With wood supports	2 "

For the cross-cut shafts there are installed three double-track overhead windlass hoists which move the coal cars and construction-materials cars. The coal cars are steel, 0.8-ton capacity cars made for 0.6-meter gauge tracks of 15-ton per meter strength rail.

Ventilation

At four places outside the pit there are ventilator fans that can ventilate the four circulation regions of the whole pit and provide an adequate exhaust system. Thus:

East part		
4th seam	One 18.5-h.p. fan	275 meters below pit entrance
6th seam	One 25.0-h.p. fan	" " " " "
West part		
3rd seam	One 35.0-h.p. fan	at air intake of pit entrance
2nd seam	One 28.0-h.p. fan	" " " " " "

At the head of the shaft being mined there is a local fan of the Meco model for creating an incoming draft.

Illumination in the Pit

In the pit there are 6,140 lamps of the Wolf point-illuminator type - safety lights using benzine - which are lent to the miners. And, for the supervisors there are seventy-seven more of the same kind.

Coal-grading Machine

The mine at Uong-bi is equipped with a sieve-separator, a hand-sorting belt and also a water dresser. The coal-grading machine at the

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mine is at a distance of about 600 meters from the pit entrance. The coal, hauled by windlass to the raw-coal storage bins (capacity 1,200 tons) and is run through the tippler. Here all coal above 120 mm is separated out by the "grizzly". All smaller coal is carried by belt conveyor to the sieve machine, of which there are two - each with an hourly capacity of sixty tons.

By these, the coal is sorted into that above 120 mm, five kinds of lump coal, and bunker coal below thirty millimeters from the water dresser.

Lump coal:	Grosses gaillettes	over 120 mm
	Gailletteries	120 - 80
	Gaillettins	95 - 50
	Braisettes	60 - 40
	Oeufs	45 - 27

The management has given close attention to the matter of not breaking the lump coal. The lump coal to be graded goes through the chute and is dropped into the coal bin and then onto the hand-sorting belt. From there it goes into the metal grill of the sieve (about thirty tons capacity). There it is loaded into the freight cars and transported to the wharves at Port Redon.

At present, since extraction of the coal from the pits cannot keep up with the capacity of the coal sorter, the coal sorter is only used about eight hours a day. The coal hauled out at night is stored in the storage bins or in the coal cars until the following morning.

The Uong-bi River is the water-way and the water source for the city of Haiphong, five kilometers downstream from the Clotilde Louise mine. And, because there is a reservoir, the Mining Bureau does not permit use of the river for washing coal. Thus, the water dresser is set up at Uong-bi village (equipped with offices, power station, work shops and other things).

This equipment (water dresser) is of the Rheo type and can handle 2,000 tons of raw coal a day. But, since the sieve separator is not turning out the same amount of coal it is used just eight hours a day and no more than five days a week.

The refined coal put out by the water dresser is as follows:

Small-lump coal -

Noix lavees	30 - 15 mm
Noisette	16 - 6
Noisette speciales pour gazogenes	15 - 10

Powder coal

Pois lavees	8 - 3
Grain "	8 - 2
Menu "	8 - 0
Tines "	2 - 0

Coal Quality

In general, analysis shows that Dong Trieu coal is harder than Hongay coal, and the proportion of volatile elements is lower. Solid carbon is contained to a considerable extent; and thus it is poor for initial burning. The carbon in that part particularly rich reaches 96.0% in some samples, and this is important for electrode uses.

Transportation

A single-track railway with 0.6-meter rails rated at twenty tons per meter has been set up from the mines to Uong-bi - 14 kilometers - and also from Uong-bi to the loading docks at Song-Da-Bach river bank and Port Redon - 5 kilometers - for an overall total of 19 kilometers. Along this the coal is transported from the mines. The hauling locomotives are Baldwin-model steam engines. There are 50 of these (inventory) of which 30 are in constant use. There are 500 coal-freight cars (10-ton capacity) and baggage and passenger cars. Of these fifty are fully enclosed.

This railway between Uong-bi and the mines follows along the Uong-bi River, with many curves having been constructed (The sharpest curve has a diameter of 50 meters.). A project is underway at present to modify some of the curves by building bridges and tunnels and improving grades. The average grade at present (between the mines and Uong-bi) is 1.7/1000, but after the improvement project is completed this will be 1.8/1000 (sic).

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Because of the steep grade, the trip to Uong-bi by the loaded cars is too fast; and the locomotives hauling the empty cars back up to the mine so not seem to have sufficient power. Particularly because of the many extreme curves of the rails as they now are laid, the dangers are great. But, on this point there is supposed to be some improvement after completion of the project.

As the railway is single-tracked, there is a mid-way station between the mines and Uong-bi where the uphill and downhill trains can meet and pass.

It is stipulated that one locomotive may pull 7 cars; but this may be increased by using two locomotives hooked together.

The Power Station

The equipment:

One 1000KW Alsthom turbo-alternator

One 1500KW Livingston turbo-alternator

Normally the 1000KW unit is running and the 1500KW unit is kept in reserve. (At the time of the survey, the 1500KW suffered a major breakdown and would be impossible to use unless the generator underwent major repairs.)

The boilers, stoked with powder coal produced by the pits, have very carefully worked-out furnace surfaces and drafts. They are Babcock and Wilcox models (Heating surface of each is 3315 square meters), with three boilers and one more being installed.

Current is supplied at 30,000V. At the receiving transformer station this is relayed for use at 110V; thus it is maintained as a low-pressure current.

Coal Extracted During the Past Ten Years (Unit: 1000 tons)

	1931	1932	1933	1934	1935	1936	1937	1938	1939	1940	1941
Coal extracted	161.8	220.2	320.3	373.3	502.1	538.3	483.6	458.2	562.6	484.8	391.9

Although the above shows the peak production as 562,600 tons extracted in 1939, from our present survey we have deduced that it should not be impossible to produce 4,000 tons daily, or a minimum of 3,500 tons,

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in view of the comparatively complete preparation of the coal seams and the bolstering of the hauling capacity of the railway.

The mine management also is sparing no effort and going ahead quite positively to improve the equipment, and they are looking to the future with considerable optimism.

Number of miners employed:	1938	9,218
	1939	9,750
	1940	6,969

5. The Ports and Their Equipment

A. Port Redon

Port Redon is the port of exit for the anthracite from the Dong Trieu Coal Mining Company and is 20.8 kilometers from Haiphong, 19 kilometers south of the Clotilde grading shop and 5 kilometers south of the Uong-bi water dresser. It is located on the north bank of the Song-Da-Bach. Between these locations runs a 15-ton Baldwin locomotive on 0.9-meter gauge track, pulling ten 10-ton coal cars. Its total transporting capacity is said to be 2,500 tons per day.

The storage capacity of the Port Redon coal depot is 200,000 tons. At the time of the survey there was stored 130,000 tons of all grades of coal because of the shipping shortage.

The Song-Da-Bach can accommodate ships of 8-meter draft as far as Port Redon (for the return journey the Hondan pilot's office provides pilots along the course). But, there is no wharf or embankment so that there is the inconvenience of having to load in the offing by lighters.

8 There are four mooring buoys to which the ships are moored; and the job of doing the loading in the offing is handled by twenty steel lighters of 100-ton and 200-ton capacity. The average total loading capacity at all four buoys is said to be 1,000 tons per 24-hour period.

There are four tugboats with engines of 65 - 140 h.p. These are used in the Tonkin Delta area along with the many powered lighters.

In loading the lighters -

(1) For lump coal, the lighters are loaded by a 15-meter conveyor belt on the bank which carries thecooal from a steel tower to the lighters.

(2) For powder coal, the bottom is dropped in the loaded coal cars on the jetty, and the coal is run through a steel pipe into the lighters.

Coal-extractive Efficiency

Since the productive efficiency of the native laborers at this pit is extremely unfavorable, much effort is being given to subsitituting machine power for human power. The results achieved are the best attained anywhere in the coal-mining industry of French Indo-China.

The amount of coal extracted per miner per day over the past three years is as follows:

	1938	1939	1940	(Unit: tons)
Miners in Pit	311	451	529	
Total force in and out of pit	164	192	232	

2. Welfare Facilities

The French Indo-China Coal Mining Company, also named the Tonkin Coal Mining Company, has far and away the best welfare facilities, with housing, a hospital, elementary-school facilities and recreation facilities. The Clotilde Louise has miners schools in two locations, with European teachers under the guidance of the mine supervisors.

Co-operative dining halls - In the past, native miners have barely been able to subsist on a small amount of coarse food because of the poor agriculture of the Tonkin delta. Suffering from chronic malnutrition, they have been unable to develop adequate working efficiency. Toocorrect this, the company has instituted co-operative dining halls which supply good nourishment at low prices.

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Food expenses -

Eating independently	Adult males	0.15 piasters/meal
	Women & youths	0.10 " "
Those with monthly agreement	per day	0.26 piasters for 2 meals

Menu:

Average per person per meal	Rice	260 grams
	Vegetables	250
	Fish	70
	Pork	40
	Salt-content	30
	Granulated sugar	5
	Tea	5

Section 3 Hongay North Area Coal Mines (called Inner Hongay)

1. Introduction

There are several mines along from Port Courbet near to the north and west areas of the Hongay mining region. The main ones are as follows:

1. Along and Dong Dang Coal Mining Company
   Affiliated pits - (a) Caida pit, (b) Dong Dang pit and (c) Daidan pit
2. M. Kysao (Annamese)-owned coal mines - Tambour coal mines
3. M. Ba-Tai (Annamese) - Neptune coal mines

This region encompasses all of the Hongay coal mines, including the affiliated Nagotna and Port Courbet pits (all currently idle). However, the small islands in Courbet Bay and the land for 80 meters up from the shoreline at high tide belongs to the French Indo-China navy's reserved mining area. This does not apply to the Hongay coal-mining area. on these small islands, and on the 80-meter strips, there are any number of small coal mines extracting coal with the permission of the navy. But, the strike either can only be followed for a short distance or it runs immediately down below the water level, so that the work is attended by many difficulties and large-scale mining is impossible. Even the largest coal mine here produces only 30,000 tons. 22

The coal seams are the same seams as those at the Hongay Coal Mines and Nagotna pit; and though they are not numerous, at least there are over four. All have a thickness of one to two meters, with an occasional swelling out to about ten meters. Around about this zone the earth strata twist and turn very much, and the strike has many sloping regions. Sometimes it slopes suddenly; other times it levels out.

In genral, these many small coal mines can only be worked in a small part, on the seashore or by the river side. And, it is doubted that they can be mined very far into the future. The coal does not add up to much value. The results of analysis and the condition of the coal seams are shown on a separate sheet.

2. The Along et Dong Dang Company (Societe Francaise des Charbonnages d'Along et Dong Dang)

Company founded	September 27, 1924
Company capitalization	11,000,000 francs (1926)
Home Company	150 Boulevard Haussmann, Paris
Offices	Hoanh-son (Prov. de Quang-yen, Tonkin)

Mines and area: (Unit: hectares)

	Name	Coal Pit Worked	Area	Total
Working mine areas	Francis	Dong Dang	372	
	Antonin	Caida	66	536
Idle mining areas	Hien	Daidan	50	
	Moussan		48	
	Lotus		47	47
		TOTAL	583	

The Dong Dang Coal Mines are in Quang-yen Province eleven kilometers west of Hongay and fifty-five kilometers from Haiphong; its communications are good. Nearby are the Van-yon and Antonin coal mines, but these are idle at present and were not surveyed. The Dong Dang coal pits are on the lowlands beside the river that flows into Port Courbet Bay; there is here a low hilly spot of just thirty meters elevation. There are ten coal seams; the strike is N. 70 degrees E. The slope is to the south 50 - 70 degrees. The seams being mined are related to the upper coal measures which continue from the region of Nagotna pit, and number some ten seams.

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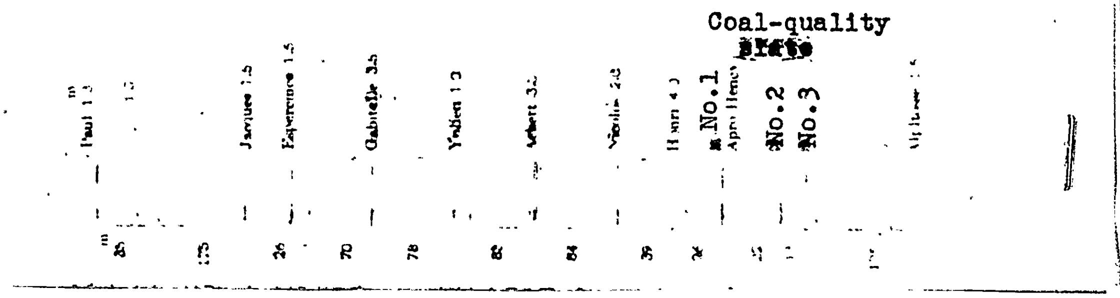
The names and order of the seams are as follows:



These coal seams have slopes of 60 - 80 degrees. And, at about the middle of the coal measures a shaft of 100 meters depth has been sunk, and the coal is reached through this and the cross-cut shafts. The Jacques, Esperance, Gabrielle and Albert seams are the most important. The Albert seam is the most favored, while there does not seem to be much interestsin mining the others. The condition of the coal seams is as shown in the figure; the thickness of the coal part which is mined is mostly from 60 centimeters to one meter. And, at the east end of the mining area the outcropping coal seam has a useable coal thickness of about two meters. It is good quality hard coal. In general, since the seams are sloping, the amount of the reserves will not be great. But, too, since the strike goes along for about one kilometer without any appreciable bends or turns, it is felt that hereafter a fairly large amount of coal (perhaps 100,000 tons per year) can be mined once the equipment for it is set in. Mining is going on down to 100 meters below the surface; and below that is much mineable area. At present, about 50,000 tons of coal per year are being mined.

The amount of coal - There is no other coal being mined other than from the four seams now being worked, so that we cannot consider any other sources as too important. Therefore, we will only give our deductions on the amount of coal in these four seams.

The total thickness of the coal is 35 meters; the strike runs for 1.3 kilometers and goes 300 meters down below the surface. It has a specific gravity of 1.5. Therefore, the amount of the coal reserves is about 1,360,000 tons. Down below water level the coal runs for 600 meters, or 3,400,000 tons.

This is a fully developed coal mine; but if it were extended and joined with thenmining area to the south-west, some increase in the amount of coal produced would be possible.

The coal seams are as shown on the columnar figure and in the results of analysis on a separate sheet.

Method of Coal Mining

A shaft has been drilled down in the middle part of the group of coal seams so that the development of the pit can be pushed ahead. There is coal mining in the pit below the water level and mining in the area on the east side where part of a seam is mined as an outcropping.

The Shaft

Diameter 3.1 meters - round and brick lined

Depth 1.05 meters (sic - 105 meters?)

Conveyance provided by a 40-h.p. reversible hoist

The gallery has been drilled out from the shaft at right angles, and they are lengthening a horizontal shafts following the seams and providing links with each seam. (The main cross-cut is 450 meters.) It is 55 meters down from the shaft entrance and is mined by the terrace method. When the survey was made, the accumulation carbon dioxide was very heavy if one moved along twenty to thirty meters from where the seam-following gallery joined the shaft; thus it was not possible to get near to the coal face. Under some difficulty, coal was being lifted out at two or three places; but the shafts for enabling this were almost closed over; and it seemed that only about ten miners were able to be mining haphazardly on the coal walls near the shaft entrance.

Though this is a pit with a recorded coal production of 50,000 tons per year in the past, already since the opening of the pit 500,000 tons have been extracted. And, today in consideration of the depth of the shaft there is almost no remaining coal which has market value. As a last, final scheme, they are turning to the protective coal walls at ground level and pushing the mining of these. As a result, cracking and sinking of the surface is taking place; and in the wet season they have to guard against the seepage of rainwater.

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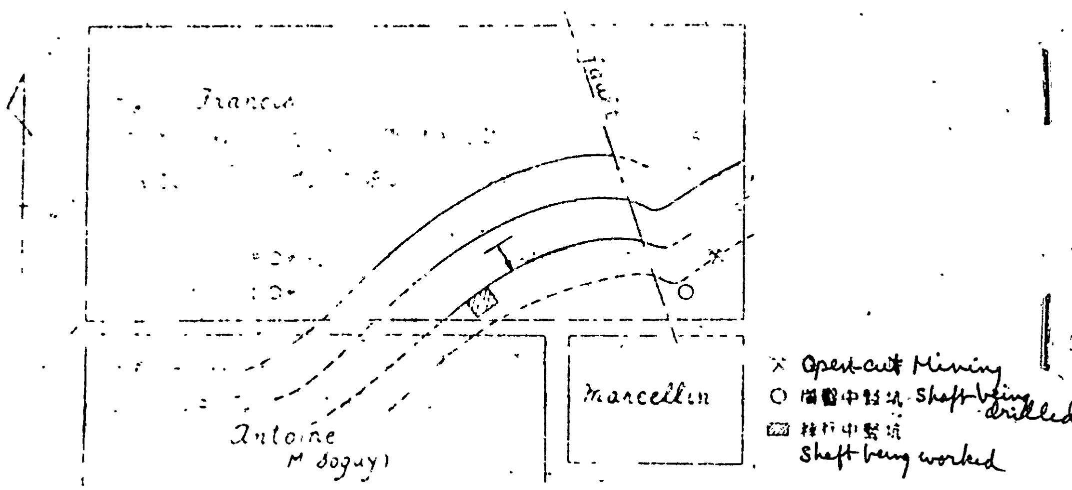
Even if they were temporarily to dig the shaft down one seam deeper, they could not hope to combine operations with the Antonin mining area neighboring on the south nor to have a connection with the shafts of the Francis mining area because of the strike and the slope.



Acetylene lamps are used for illumination in the pit.

Ventilation

Outside of the pit there is installed a 15-h.p. electric fan which brings air in through a central ventilating system.

Drainage of Water

On the east side of the mining area there is one place where open-cut mining is being engaged in. And, because the pit mining is close to ground level, as mentioned above, cracks have appeared in the surface. So, in ordinary times water seepage amounts to 20 m^3/hr, and is over 140 m^3/hr in the rainy season. So, the pit is equipped with one 15-h.p. pump, two 30-h.p. and two 50-h.p. pumps, for a total of five.

Open-cut Mining

There is one place where there is open-cut mining in the east side of the mining area; but because of the steep slope of the coal seam, the exposed part soon goes underground and economical extraction becomes impossible. So, a small shaft is being dug to convert this to pit mining. But, since this is an area of bends and turns, this will be only a small area; and the amount of coal extracted should not be great.

Coal-grading Shop

Near to the shaft entrance there is a sieve separator, said to have a capacity of twenty-five tons per hour.

As the coal seams easily fender powder coal, there is not much lump coal; 85 % of the coal is in powder form. The lump coal is only classified into:

Braisette lump coal	above 30 mm
Noisette pea coal	30 - 15 mm
Grain powder coal	15 - 8 mm
Menu powder coal	8 - 4 mm
Menu powder coal	4 - 0 mm

However, that above 30 mm is run over a steel sheet for handing sorting out of foreign matter. The ash content of the powder coal runs from 6 - 22%. Coal extracted from the open-cut diggings only has the stones sieved out.

Conveyance

Coal taken from the sieve machine goes according to size into 0.5-ton coal cars to the refined-coal storage depot near the lighter docks. The cars are made of steel and run on 0.60-meter gauge rails of 9-ton/meter capacity, running for 2.5 kilometers to the wharves. The coal cars are pulled by two 5-ton Decauville locomotives.

Power (Generator station)

There is one 50KW alternator, with two Wilcox model boilers. And, besides these, there are two or three aged and incomplete boilers and alternators. We were told that in the rainy season there is no extra power source to use while the pumps are running and the other machines have to be shut down.

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Ship loading

The wharves are on both sides of Courbet Harbor and face the mouth of the Van-yen. This is about 2.5 kilometers from the pits. IN between there are laid 0.6-meter gauge rails for light railroading.

Lighters up to 150 tons can be moored alongside the wharves, and the coal can be moved in bamboo baskets from the storage depot to the lighters, and thence to the depot ships anchored in the Port Courbet offing some 10 kilometers away.

The storage depot has a capacity of about 20,000 tons.

The Briquette-coal Factory

Here briquette coal is manufactured by mixing powder coal from the local mines with bituminous coal. But, in the last few years there have been many difficulties in getting bituminous coal and coal pitch, so that these operations have ceased.

2. Caida Pit

To the north of the Hongay mining area, facing on Port Courbet, there is worked the small, 66-hectare Antonin mining area. It is partly enclosed by the Tambour mining area belonging to the Annamese M. Kysao. This pit is the best of all the coal mines in the neighborhood of Port Courbet.

The whole mining area has the shape of a cape jutting into Port Courbet. At high tide lighterss(of about 100 tons) can come through the canal for loading; but at low tide this all turns into a wide dry beach, and small boats are pulled across the mud like sledges.

The coal seams are five in number - from top to bottom:

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	Thickness of seam (meters)	Thickness of mineable coal	
1st seam	7.0	1.5 - 2.0	On the reverse slope a sloping shaft is being dug which has not yet reached the coal.
2nd seam	12.0	6.0	Being mined from open-cut diggings.
3rd seam	5.0	2.0	Called C Pit; being developed from within a pit.
4th seam	0.3	-	Not mined.
5th seam	2.2	2.2 (not favorable)	Called D Pit; being excavated.

In addition, on the south side of the hill there is open-cut mining and pit mining of a small scale called "badger digging", but the grade of the seam is not clear.

The open-cut mining of the second seam is an important mining site and is worked vigorously by 100 men, extracting about fifty tons of coal per day.

C Pit has a daily production of twenty to thirty tons, so that overall porduction is 120 to 130 tons per day. The coal quality easily runs to powder, and there is a high ratio of sulfur. For loading the depot ship, 100-ton lighters (which can come right up near to the pit entrance at high tide) are used. And, the depot ship can be moored two kilometers from the pit entrance.

3. Daidan Pit

On the west side of the Daidan pit is the fifty-hectare Hien mining area where coal was once mined, but which is now idle. Since it is small scale and the coal is not of good quality, we have omitted it from our survey.

Annual Coal Production of the Dong Dang Coal Mines During Past 10 Years

Unit: 1000 tons

	1931	1932	1933	1934	1935	1936	1937	1938	1939	1940
Dong Dang Pit (Incl. Daidan)	32	21	35	42	40	41	41	55	34	35
Caida	30	29	7	-	-	-	-	-	30	34
TOTAL	62	50	42	42	40	41	41	55	64	69

Number of Miners at Dong Dang Coal Mines

	1938	1939	1940	1941
Total in three pits	550	750	900	500

Coal produced by these pits is being imported into Japan under the name "West Hongay coal".

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3. Tambour Coal Mine

Name of Coal Mine	Tambour
Mining Rightholder	M. Kysao (Annamese)
Mine Being Worked	Tambour
Area	431 hectares

Tambour coal mine

Tambour coal mine is a mine belonging to the Annamese M. Kysao. It includes the north and south Tambour pits. The Tambour mining area, including in its midst the Antonin mining area of Caida pit to the north of the Hongay mines, is operating 431 hectares. Upper grade coal seams are worked at the north pit and the lower grade seams at the south pit. The coal seams being worked in the south pit all have an east-west strike and a forty-degree gradient to the north. The mine depth is forty meters, and near to the overlying rock is a section ofcoal 2.2 meters thick.

Besides that, there is coal-quality slate. There have been drilled two sloping shafts for working below the surface.

It is said that last year 25,000 tons of coal were produced here. The coal is anthracite, mostly powdered.

The north pit is about one kilometer north-east of the south pit; and this too has sloping shafts for working the coal, the strike of which is North 20 degrees West. There is a 28-degree gradient to the east. The coal seam is eight meters thick, with no outcroppings to be seen. (The coal can be mined to twenty meters.) Most of it is powder coal; and last year's production was said to be 25,000 tons. The results of analysis of the coal from the pit shows medium anthractie, as shown on the chart.

Both pits are on quite low ground; around the area of the pits there areecanals for moving the lighter traffic. With the earth and gravel dug out of the pits embankments of two to three meters have been thrown up to keep out the sea at high tide.

At both the north and south pits mining goes on below water level. The sloping shafts are dug along the true slope within the coal seam. The shaft in the north pit extends for 150 meters; that in the south pit,

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100 meters.

Conveyance

In the pits there is no railway, only the hoists in the sloping shafts. Bamboo baskets are used to move the coal away from the mine face. Tehn, it is loaded into skips at the mouth of the sloping shaft and taken out of the pit.

(The sloping shafts are quite steep so that to use ordinary coal cars hitched together would be dangerous. Both the north and south pits haul the coal in 0.5-ton skips.)

The coal from the skips is put into regular ore cars near the pit entrance and is hauled to the sieve separator.

Both pits produce almost entirely powder coal, from which the rocks must be sieved out. The size proportions in the coal are:

	North pit	South pit
Above 10 mm	17 %	10 %
Below 10 mm	83%	90 %

The coal under ten millimeters is checked with the naked eye of the coal sorters, who separate it into four classes by color:

			North pit	South pit
A Powder coal	ash content	under 80%	25%	30%
B Powder coal	ash content	under 11%	25%)	60% (B, C, D)
C Powder coal	ash content	under 15%)	33%) (C, D)	
D powder coal	ash content	under 24%)		
		TOTAL	83%	90%

Water Drainage

Both pits pump out water in ordinary times at about twenty cubic meters per hour; but in the rainy season there is great danger from water seepage; and mining operations are shut down in order to work on reinforcing the mines and flood protection of the shafts. In each shaft the pumps are operated by steam power.

Power

Near to the entrance of each pit there are two vertical boilers installed which provide the power both for the skip windlass and for the pumps.

Coal Extraction

Annual Production of Coal for the Past Ten Years

(Unit: 1000 tons)

	1931	1932	1933	1934	1935	1936	1937	1938	1939	1940
From both North & South pits & S Pits	2.2	4.2	6.8	15.7	50.3	29.0	20.6	34.1	26.5	52.6

Number of Coal Miners: 1939 - 515 1940 - 716

The coal produced by Tambour is marketed through the Along et Dong Dang Company (under the name "West Hongay Coal").

Ship loading

Lighters are loaded near the pits and taken to the depot ships in the Port Courbet offing.

4. Neptune Mine

Mine name	Neptune
Mine Rightholder	M. Ba-Tai (Annamese)
Mine region and area	
Region	Neptune
Area	460 hectares
Mine supervisor	M.R. Seguy

Ba-Tai Coal Mines

Neptune pit

Though Ba-Tai (an Annamese) is the mining rightholder, M. R. Seguy has been paid one piaster per ton of coal produced during the six years since 1936 under the conditions of the mining contract in effect.

The name of the mine is Neptune, and the area is 460 hectares. It is located on the north of the Hongay mining area to the north-east of Tambour pit and occupies the south-east bank of the Song Dien Vong.

The coal seams altogether are about thirty meters thick. They are partly dug from outcroppings. The good quality coal amounts to fifteen to sixteen meters of the part excavated down to about forty meters below the surface. (There is water standing in the bottom.)

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The seams have many bends and turns, but all turn out fine-powder coal. The strike is about 100 meters long and tapers down to nothing because of a fault.

Judging from the great degree of bending and from the great amount of changeability in the seams, we believe it is possible that a certain amount of expansion may take place in the present mine sites. The strike is North 60 degrees East, and the slope is 25 degrees to the West; but because of the great amount of variation, the slope is irregular.

The coal from this mine is shipped to Japan and is said to be a mixing coal in the manufacture of coke at Wakamatsu.

Methods of Mining

In the open-cut mining there are five to nine terraces. The height of each is not fixed, but varies. And, in the exposed coal seam the part with the good coal is in the center.

Down to the middle terrace there are rails installed; the rail cars are hauled up by windlass. But, the coal from the bottom is hauled up in bamboo baskets to the middle terrace for loading into the coal cars. The locomotive is a steam-powered 25-h.p. engine with two small boilers. The rails are 0.6-meter gauge with nine-ton per meter capacity.

At the time of the survey, it was about the time for the celebration of the Annamese New Year, and the workers were laboring most diligently. Yet, with 3,000 men working, they were achieving a daily production of only 1,000 tons per day.

The extracted coal is divided by sieving through a 15 mm-mesh sieve into 1) coal bigger than the mesh - 20%, and 2) coal smaller than the mesh - 30%.

Coal quality - soft bituminous coal with a low ash content in general; thus it is imported into Japan as a raw material for coke.

Water drainage

During normal times water pumped out of the mines amounts to about thirty cubic meters per hour. This is easily handled by running one forty cubic meter per hour pump for 17 - 18 hours a day. But, in the wet season the rate of water seepage is 90 - 120 cubic meters per hour, and the capacity of the stock pump is insufficient so that the site of operations becomes flooded. It is said that it takes from August to October to drain out this water and restore the site.

To reduce the amount of accumulated water, earth and gravel stripped off from the open-cut diggings is piled around facing the entrance; but such make-shift measures are not enough. An increase in pump capacity is absolutely essential.

Coal Extraction

The large number of aged and young miners was something we found particularly noticeable.

Shipping

Lighters are used at the shore, picking up the coal and taking it to the depot ships in the offing.

5. Port Courbet

This is the port of shipment for coal extracted by the mines located in the area of Quang-yen Province of Tonkin state; it has been used since long ago. Located between capes Hongay and Vachay, it is very admirably situated from a topographic standpoint; and without adding any work to it, the port was ready for use in its original state. However, it is silted by the inflowing rivers until it becomes quite shallow, there being but a few areas where it exceeds ten meters in depth.

Also, the Bay of Along - outside the harbor - is shallow, with coal rock for its base rock and with many hidden shoals so that ships can enter the port only with difficulty after threading their way through the four-meter channel with the guidance of pilots.

Using this harbor at present are chiefly the following:

Pit	Annual Production
Dong Dang	30,000 - 35,000 tons
Caida	30,000 - 50,000
Tambour	20,000 - 30,000
Neptune	20,000 - 34,000

And, also it is used by the Van-yen, Paul, Chateau, Van-nho and Song au Dzuong pits, each with a production of roughly 2,000 to 5,000 tons. These latter have but little coal, and are presently idle.

The total coal extracted per year is 110,000 to 150,000 tons.

The Hongay pits have good harbor arrangements, with comparatively deep water and with most of the shoreline a finished embankment for loading operations; but at the above small, weak pits there is no real capacity for making improvements to the harbor. There are not even any buoys so that loading has to be done from lighter to depot ships in the offing.

When conditions are such that the amounts loaded onto the depot ship would make unsafe the passage through the harbor's four-meter channel, the maximum load at the harbor is set at 6,000 tons, and the ship is filled up the rest of the way about fifteen kilometers out into the offing. This is similar to the situation for depot ships at Port Hongay wharves, where 6,000 tons is the limit and the depot ships are sent on to a second port - Campha - for filling up the rest of the way. The French Indo-Chinese government authorities have to spend a large sum of money yearly for dredging the silt out that flows down the Haiphong river port. But, Port Courbet has been under survey since last year as a strong candidate for replacing this port. There will be no small amount of return if this is carried through to realization.

The loading capacity of this port is held under contract by the Annamese owners of the 900-ton lighters, while the 700-ton and 400-ton lighters owned by the Neptune mine is for continued useage.

A maximum shipping capacity of 1,000 tons during a twenty-four hour period has been recorded, but observing the average of eight (sic) tons, this is not great. The pit's lighter wharf can accommodate 200-ton lighters at high tide. But, at low tide it becomes a dry beach, and not even small ships can pass. So, when there is no depot ship in port, the lighters have to carry the coal out to the small islands in the harbor, such as Charbon I. and Boisee I., and store it there so that the loading of the depot ships will be facilitated.

Section 4 The West Dong Trieu Coal Fields Region

1. Condition of the coal seams and the geology of the Bicho, Chacha and Mao-Khe coal mines

The three coal mines of Bicho, Chacha and Mao-Khe all have the same coal measures so that we can consider the condition and geology of the coal seams all together.

Location and Communications

These three mines are 24 kilometers north of Haiphong and are on a line from east to west in the order Bicho, Chacha and Mao-Khe, with the coal seams continuing for 16 kilometers from Bicho to Mao-Khe.

From Haiphong to these mines there is a paved highway, which an auto travels in about 1½ hours. Along the way are two ferrying points which take up considerable time in comparison to the distance covered.

The coal produced at each mine is hauled to the Song-Da-Bach via a light railway and is loaded onto lighters at Port Redon for delivery to the depot ships.

Topography

These three mines are located on an approximate east-west line on the south flank of a mountain range. To the south on the broad flatlands of the Haiphong delta one can see any number of isolated hillocks of coal rock, this scenery being distinctive to the Baie d'Along. To the north, there is a fairly high 500-meter range, the composition of the rocks there being chiefly breccia and sandstone. Thus, the rock formations create the topography, which shows the peculiar "kesta" [phon. translit.] formation and results in almost treeless, bald mountains.

Geology

The geology of this vicinity is chiefly made up of sandstone and breccia, with a number of coal-seam strata interposed. These coal measures cover limestone rock and are of quite high grade. In the Hongay region, the coal measures of limestone and breccia are not to be seen, from which it can be deduced that these are lower coal measures lying out of conformity directly above the Palaeozoic-era limestone.

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At Hongay it is believed that faults and non-conformity keep these coal measures from outcropping. The thickness of the coal measures is above 500 meters, while near to the lower sections there are many seams interposed with breccia. The twists and turns are quite extreme, and the connection between the seams of the three mines is not yet clear.

From the central part of the Mao-Khe mine there is a single anticline fault on a N70°W strike which runs across to the south part of the Bicho mine. In the north wing the strata have an approximately east-west strike and a gradient 20°- 60° to the north; in the south wing near the fault they are nearly horizontal. But, as they get farther away, they form a gentle slope and show a wave-like formation. Thus, the topography, too, is gently sloping and flat.

Coal Seams

The lower coal measures of the Bicho-Chacha-Mao-Khe coal-mine belt contain much foreign matter and have many twists and turns. And, in the future it will be difficult to make the coal mines capable of producing large amounts of coal. The coal quality, too, has a high ash content and is of poor quality. We do not believe that there is as much coal here as has been computed.

2. Chacha coal mine (Societe Anonyme des Charbonnages de Chacha)

Capitalization	75,000 piasters
Mine Name	Chacha
Holder of Mining Rights	Chacha Coal Mining Company

Mine Area	Hectares	Date Established
Chacha	499	January 30, 1907

Mine Supervisor	M. Roche Felicien

The Chacha mine is about 8 km west of the Bicho coal mine; and the coal seams being worked are located on the north wing of an anticline fault. This corresponds to the Mao-Khe mine's A seam (In quality it is believed to correspond to that of the K seam.); and there are the 50 seam [meters?], 40 seam, 60 seam, 80 seam and 5 seam. Excluding the A seam, all the other seams have a height of less than 0.9 meters; and there are no seams with more than 0.85 meters of lump coal. With powder coal predominating, we do not consider these very hopeful.

The A seam has an east-west strike and a 46-degree gradient to the north. The upper layer, 1 meter thick, is covered by 7 meters of rock. The lower layer then lies below about 2 more meters of rock. The upper layer has only banded coal. The lower layer has about 1 meter of coal. However, there is much coal-quality shale rock interposed, so that the ash content is considerable.

At this coal mine, the level of the mine entrance is on a mountain range more than 200 meters above sea level. For moving the coal, an automotive hoist is used from any level to reach the level of the railroad. Then, the coal is hauled by railroad more than 5 km to the lighters. In doing this there are great inconveniences. The amount of coal extracted monthly never exceeds 3,000 to 4,000 tons, nor is the coal of very good grade; thus we feel that this mine has but poor prospects for the future.

Coal Mining Methods

The coal seams all have outcroppings on the high parts of the hills. And, the cross-cut shafts and shafts directly following the coal seams are dug and mined by a very simple "short-wall mining system. On the west side the mined coal is run down an automotive sloping track in three stages in coal cars of 0.5 ton capacity to the railroad on level ground. On the east side the coal is carried down by a single-stage hoist and by a three-step sloping railway - a complicated system. In addition, the railway presently being extended on the south side of the southerly holdings of Dong Trieu will enable mining in the region west of the fault in the Pluton and Ganymede seams, which are in the south-west corner of the Espoir mining region of the Dong Trieu pits.

In general, the coal actually mined, not including the foreign matter, is mined in the better parts first so that the ash content mixed into the poor sections can be avoided and the mining will be easier. The amount of coal above the water level is considerable; and at present a cross-cut shaft is being drilled so that the extracted coal can all be collected here and the present complexities and difficulties in hauling can be resolved, enabling easier increases in production.

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Coal Grading

Outside of each pit the coal is separated into that above and below 30 mm. The foreign matter in the coal above 30 mm is sorted out by hand; and the coal is sent to the storage depot at Song-Da-Bach.

At the storage depot on the bank of the Trang-Bach, a tributary of the Song-Da-Bach, the coal is graded according to the requirements demanded by the market, as follows:

		% of this grade	
Large lump (Crible)	over 50 mm	3.5	) 12.5
Medium lump (Braisette)	50-30 mm	9.0	
Small lump (Noisette)	30-18 mm	10.0	
Bean lump (Grain)	18-12 mm	6.5	) 87.5
Powder coal (Menu)	12-0 mm	71.0	

Transportation

The coal cars running down to level ground are hooked together 10 to 15 at a time as a single train for hauling the coal to the Trang-Bach storage depot. There are two steam-powered locomotives weighing 9 and 12 tons. A single-track line 4.5 km long has been constructed from the mine to the depot - with 0.6 meter gauge rails of 9-12 ton capacity.

The Storage Depot

The storage depot is on the west bank of the Song-Da-Bach tributary, Trang-Bach. It can handle about 40,000 tons at a time. And, here the coal is sieve-graded again into the grades noted above.

Ship Loading

The river depth is 1.5 - 2.0 meters and can take 50-ton lighters. The coal is hand-loaded from the storage depot in bamboo baskets. For trans-loading from the lighters to the depotships the lighters go down-stream to the offing of Port Redon or Port Haiphong.

Table of Annual Coal Production for Past Ten Years (Unit:1000 tons)

1931	1932	1933	1934	1935	1936	1937	1938	1939	1940
39.8	56.6	21.4	12.1	20.2	17.0	31.4	48.8	45.8	40.6

No. of Workers: 1939 - 400 ; 1940 - 311 ; 1941 - 257

3. The Mao-Khe Coal Mine

The coal mine is managed by the Tonkin Anthracite Mining Company (Societe des Anthracites du Tonkin), having been annexed in 1933. Today it is in the western part of the Quang-Yen coal seams at a point 32 km down the road from Haiphong, neighboring on the Chacha mine on the east.

	Name of Concession	Area (Hectares)	
Operating Concessions	Schoedlin	1,190	2,050
	Bon Espoir	134	
	Edouard	726	
Idle Concession	Rosette	90	
	TOTAL	2,140	

Mine supervisor: M. Huas

Coal Seams

The Mao-Khe mine is a branch mine of Hongay Coal Mines and is at the western end of the mountainous area that includes the coal measures continuing from the east part of the Bicho mine. The western part is level, while in the east the mountains become quite steep. The coal measures here form an abrupt anticline. There is a major fault along the anticline axis on an east-west line.

In the western part the north wing of the anticline forms a gradient of more than 80°, but further to the east it gradually becomes more gentle - sloping 30° - 40°. The south wing of the anticline in general slopes quite steeply, being almost vertical.

There are six coal seams: D, C, K, B, A and M. Those presently being worked are the A and B seams of the north wing and the K seam of the south wing (This is identical to the A seam of the north wing, but in many respects the details of the seam are different.).

In the exposed outcroppings of the A seam there is almost no coal, but within the pit it is somewhat better developed. The B seam is approximately 60 meters above the A seam, and its shaft is about 2 meters high, with the coal portion amounting to about 0.7 meters. The K seam has a shaft of about 7 meters height with about 140 meters [sic - 1.40 ?] of coal. For the most part the mining is from open cuts, but as of now a shaft is gradually being dug below ground level. As stated above, the

K seam has quite a thick coal section; but since it is a vertical seam a great amount of coal cannot be expected from it. And, as A and B seams are very twisted, the future possibilities for the Mao-Khe mine are slight. Its production is directed only toward domestic requirements and is not of good enough quality for export. (The annual production here is several tens of thousands of tons.

Mining Methods

Running north from a site 13 meters high on the right bank of the Trang-Bach river, there is a cross-cut shaft of 470 meters, piercing the M and A seams and reaching to the coal ofthe B seam. And, there are shafts extending into the coal in A and B seams. The long-wall lateral-thrust coal-face clearing is the method of mining. The coal is carried out by coal carts on a slope.

Ventilation is handled by natural circulation, taking advantage of the differences between the top and bottom.

Coal Grading

Coal extracted from the mine goes through the sive-separator shop (capacity - 40tons/hr), where coal above 50 mm is sent to the hand-grading belt, from which the foreign matter is removed before the coal goes on to the storage depot.

The remaining coal has the part under 12mm removed, and it is graded in the water-dresser into the following three grades:

Medium lump	50-30 mm	Ash content 6.0 %
Small lump	30-18 mm	8.0
Very small lump	18-12 mm	10.0

That under 12 mm has an ash content of 25.0% so that it is not good for bunkering and is used up locally. Having a high ash content and being only 5.0 % lump coal, it is of poor quality and is not exported, rather being used to meet domestic needs.

Transportation

The coal is hauled from the pit to the mine's storage bins in coal carts of 0.5 ton capacity on 0.6 meter gauge rails. From the bins the coal goes into 4-ton capacity steel coal cars and is taken to the coal-grading shop. The locomotive is a 12-ton steam engine, of which there are nine. And, there are 80 coal freight cars, each with a capacity of 4 tons; these are coupled into 8-car trains.

The total rail distance travelled by the trains from the mine's storage bins, past the coal-grading shop to the shipping wharf and storage depot of Song-Da-Bach is 11.0 km. The rails are 0.6 meter gauge with a load capacity of 15T/meter.

The Coal Storage Depot

Attached to the lighter-loading wharf at Song-Da-Bach is the coal storage depot, capable of storing 20,000 tons of coal separated into grades and types. Further, near the coal-grading shop is a single site where 10,000 tons can be stored, so that the total capacity is 30,000 tons.

The Wharves

The wharves are 3 km from the coal grading shop on the north shore of the Song-Da-Bach. Here the coal from the freight cars is loaded directly into the lighters from the jetty; and that from the storage depot is loaded with considerable effort from baskets holding 20 tons. The lighters are 50 - 200 tons weight. From all the supply points of the Tonkin delta the coal is carried directly to Port Redon and loaded into the depot ships.

The depth of the water here is around 2.0 meters; and the maximum loading capacity per day is no more than 500 tons.

Power

There is a 500KW capacity thermo-generator station, but it is not in use. At present, power is being supplied by a power company in Haiphong, meeting all the requirements of the mine.

Coal Production during the past Ten Years (Unit: 1000 tons)

1931	1932	1933	1934	1935	1936	1937	1938	1939	1940
169.1	104.9	76.1	60.0	73.0	133.3	129.6	139.9	148.4	164.6

(At the time of the inspection - January, 1942 - we estimated 2,000 workers.) Number of workers on payroll for past three years:

1938 - 2,817 1939 - 2,672 1940 - 2,352

The welfare facilities are the same as the Hongay pits.

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4. Charbonnages Bach-Thai-Buoi

Name of Coal Mine: Bicho

Holder of Mining Rights: Bach-Thai-Tong (Annamese)

Mine Supervisor: [text blank]

This mine is under the joint management of the heirs of Bach-Thai-Tong. It is in Quang-Yen Province (Tonkin) and extends from the Dong Trieu south range. It is made up of two concessions - Alexandre and Fabien,- which lie between the Espoir and Berthe concessions of the S.C.D.T.

	Name	Area (Hectares)	Date Set Up
Operating Concession	Alexandre	1,200	June 26, 1915
Idle Concession	Fabien	724	March 27, 1915
		TOTAL 1,924	

Coal Seams

In the Bicho mine there are four seams: B, Apis, A and D, in the south wing (Fabien concession) of an anticline formation. These slope to the south and are 3.8, 2.0, 8.4 meters and 6.0 centimeters thick respectively. The coal is of inferior quality and is not mined. In the north wing (in the Alexandre concession) there are five seams of coal: from bottom to top, the T, B, A, C and H seams. Of these, some working is going on in the T and B seams. The others are not being worked, and are probably coal-quality shale.

B seam is a seam of poweder coal, with a total thickness of 2 meters and a coal portion of 0.6 meters, so that it is not a seam with much of a future. Above the water level it is already completely mined out.

The T seam is being mined from a single terrace above water level. At present they are working a newly discovered outcropping with a seam of 2 meters, having about 1 meter of coal. The coal isnnot of good quality; containing much coal-quality shale, it is believed to have poor future possibilities. The strike is N60°E, with a gradient of 40° to the north.

So, the coal seams of the Bicho mine are not of good quality. And, with financing relationships holding up the coal extraction, there is but little expectation of future development. There is not enough coal to bother computing the amount.

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Method of Extraction

As the coal seams are in a high location, for a vertical distance
of 60 meters between 100 and 300 meters above sea level the mining is
conducted along horizontal shafts following the seams, using the terrace
method. The extracted coal is lowered to the lower terrace levels by
a relay method along automotive sloping tracks.

Also, recently in the central part of the concession (400 meters
elevation) an outcropping of the T seam has been comparatively systema-
tically and continuously exploited. A large-cross-cut shaft is being
drilled 100 meters from ground level; when it is completed it will be
reached also by an automotive sloping railway for taking out the coal
which will be collected there.

In order to keep extracting sufficient coal, shaft are being drilled
for digging the coal in three places between 300 and 400 meters below
the surface, additional to the old level shafts following the seams.

Transportation

At present, there are four levels for extracting the coal from the
upper parts of the pit. For the lower part there is on one level an
automotive sloping shaft through which the coal is taken to be collected
at the level 100 meters above sea level, and then to the coal-storage
bins in the large coal-freight cars.

These large ore cars have a ten-ton capacity (There are 15 of them.),
and they run on a single-track 0.6 meter gauge railway with 12T/meter
capacity rails to Port Bicho - a distance of 12 km. The coal cars in the
pit are pulled by 5 - 11 ton steam locomotives (of which there are 4) in
0.5 ton cars, running on 0.6 meter gauge rails. There are 200 of these
cars.

Coal Grading

The coal is hauled raw to the storage depot at Port Bicho on the
bank of the Song-Da-Bach and is sorted only into three classes:

Gros Crible	Large Lump	over 50 mm	15% of the total
Noisette	Medium lump	50-30 mm	3%
Menu	Powder coal	under 30 mm	82%

Port Bicho

Port Bicho is about 8 km south of the mine, on the north bank of the Song-Da-Bach and is northwest of Port Redon (upstream) about 4 km. It is serviced from the mine by a light-duty railway of 0.6 meter gauge, over which 5 to 11 ton locomotives (of which there are two) haul 15-car trains (each car with a 10-ton capacity).

The water depth here is 3 meters. There are no loading facilties at the port; but from the south side of a small coal hillock with some embankments junks and sampans can be loaded.

In any case, the coal is loaded into bamboo baskets (about 15 km capacity) and thence into 30 to 200 ton lighters or junks and shipped directly to Haiphong or other major terminals.

The storage capacity is about 10,000 tons. The coal bound for France is hand sorted at Port Bicho. And, also local requirements are filled from here.

Table of Coal Extraction during Past Ten Years (Unit: 1,000 tons)

1931	1932	1933	1934	1935	1936	1937	1938	1939	1940
-	7.6	18.2	25.5	27.8	17.1	3.8	3.4	5.8	8.5

Number of miners: 1939 - 123 1940 - 204

5. Co-Kenh Coal Mines

Name of Coal Mine	Co-Kenh		
Holder of Mining Rights	M. R. Seguy		
	Name	Area (Hectares)	Date Set Up
Operating Concession	Clairette	240	May 18, 1908
Idle Concessions	Le Chambon	550	
	Noyant	424	
	TOTAL	1,214	

Mine Supervisor: M. Roche Felicien

This mine is in Hai Duong Province, 18 km west of Dong Trieu. Its coal measures are believed to be extensions of the coal seams being worked at Bicho and Mao-Khe, i. e., the lower coal measures. It is in a single chain of hills standing alone on the plain west of Dong Trieu. It is just 2 km off the rail line between Hongay and Hanoi. And, it can be reached from Haiphong in about 2 hours by auto. The coal extracted is transported on the nearby river in lighters to Haiphong. The mine belongs to the same company as the Chacha mine.

There are many coal seams, but none of them are of good quality. Those now being slightly worked are about 1 meter thick, and the coal portion of this is no more than 0.6 meters. The strike is approximately east and west, with a 30° gradient to the north.

The coal is powder grade; and while the volatile portion is low, the water and ash content is high - about the same kind of poor coal as at Mao-Khe.

<u>Method of Mining</u>

The old pit is called No. 5 pit. Here all mining above the water level is finished; and while mining has begun below the water level, it is presently flooded. Plans are ~~xxx~~ now being pushed for mining from a shaft. The site now being worked is at the No. 9 pit in the west part of Le Chambon concession. One seam has a thickness of about 1.8 meters, and the drilling of a sloping shaft here has proceeded some 80 meters. Also, 30 and 80 meters down there are being developed horizontal shafts along the seams; these are being mined by the short-wall terrace method (lateral thrust). About 0.8 meters of the 1.8-meter seam being mined is coal. Eighty meters above this seam is a 2.0-meter seam, and 100 meters below it is a 2.5-meter seam; but their actual nature is not known.

The ground around the mining area is paddy land. And, in order to prevent water seepage through cracks caused by the mining, mine tailings are used to make dikes. Still, the amount of water pumped out is 50 - 70 cubic meters per hour. For this purpose, one 14-h.p. and one 12-h.p. electric pump run almost continuously.

The sloping-shaft hoist is an electric 15-h.p. machine. As it would be dangerous to raise regular coal carts up the steep slope, 0.5-ton capacity skips are used. These are raised up to the pit entrance and dumped onto a chute running down to the coal cars. These coal cars are models that can be overturned and have a capacity of 0.65 tons.

The Coal Storage Depot

The coal storage depot is on the right bank of the tributary ~~of the~~ Song-Kinh-Thay about 2 km from the mine. It is reached via a single-tracked 0.6-meter gauge railway with 12-ton/meter capacity rails. The depot has a storage capacity of 2,000 tons.

The rawh coal from the mine is sieve-separated here, thus reducing the number of loadings and unloadings so as to prevent powdering of the coal as much as possible.

The grading standards are:

			Top % achieved
Large lump	Crible	above 50 mm	15.9
Medium lump	Braisette	50 - 30 mm	
Small lump	Noisette	30 - 18 mm	
Bean lump	Grain	18 - 12 mm	84.1
Powder	Menu	12 - 0 mm	

Power Equipment

There is one 75-h.p. generator used to transmit current to all areas at 250V.

Table of Coal Extraction during Past Ten Years (Unit: 1000 tons)

1931	1932	1933	1934	1935	1936	1937	1938	1939	1940
15.6	14.2	10.2	11.3	16.0	17.8	23.3	11.1	12.9	4.6

Number of miners: 1938 - 34 1939 - 53 1940 - 87

Ship Loading

The docks are on the lower reaches of the Song-Kinh-Thay, a tributary of the Cua Cam River. The water depth is 2 - 3 meters, enabling the docking of 200-ton lighters. Coal is carried into the lighters in baskets slung on shoulder poles.

The local markets are reached by the lighters themselves, but farther markets are reached by trans-shipping on depot ships from the offing of Port Redon or Haiphong.

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CHAPTER 3

BITUMINOUS COAL MINES

Section 1. Societe Indochinoise de Charbonnages et de Mines Mitalligues

Company founded: 1924

Capitalization: 20,000,000 francs

Main Office: 51 Rue d'Anjou, Paris

Branch Office: Phan-me (Province de Thai-nguyen, Tonkin)

Name of Coal Mine: Phan-me

Holder of Mining Rights: Indo-China Coal and Metal Ores Mining Co.

Concessions and Area:

	Name	Area (Hectares)	Date Set up
Operating Concessions	Coloung	2,400	Feb. 14, 1914
	Toling	2,400	-
Idle Concessions	Germaine F	1,239	May 25, 1913
	Germaine B	475	May 30, 1913
	Song Cam	2,400	May 25, 1913
	Louisette	1,600	April 25, 1913
	Bonne Esperance	2,400	April 25, 1913

Mine Supervisor: Lavastre

Location, Communications and Topography

The Phan-me coal mine is in Thai Nguyen Province, Tonkin State, approximately 90 km north-east of Hanoi; and it is 15 km north of Thai Nguyen. Existing communications make possible a 2-hour auto trip from Hanoi. The coal is hauled over a narrow-gauge railroad for about 20 km to Thai Nguyen, where the lighter docks are. The lighters use the rivers and canals, going through Phu Lang Thuong to the Haiphong area. (The canal has been built from a point 5 km south of Thai Nguyen to Phu Lang Thuong - about 70 km - and is used chiefly for transporting the coal of this mine and the iron ore of Thai Nguyen.)

This coal mine is in the northern hill area of the Tonkin delta, in a basin of limestone and other rocks. The neighboring hills are not over 100 meters high.

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Geology and Coal Seams

The geology here is made up of the same palaeozoic limestone base rock as in the neighborhhod of Hongay; and the Mesozoic coal measures which cover this in non-conformity are a north-westerly extension of the coal measures of the Hongay-Dong Trieu region. However, because of the non-conformity and faults, they do not appear as regular strata. The coal measures themselves have an almond shape and only occur here and there.

The continuations of the coal seams in this Phan-me mine are just one 400-meter stretch along the strike,-one stretch of about 300 meters and two "blocks." The rest are too small to be considered. The block presently being worked is called North Lang Cam. The strike is about north and south and has a gradient to the east of about 70°. But, it is extremely irregular, and there are many small faults within the pit. Also, the other block is south of the one noted above and is called South Lang Cam. Its strike is east and west; and it is said to be mined only to a depth of 55 meters.

The coal seams of this mine do not always stay wide, forming almond shapes that swell from 1 meter to 10 meters or more. There is almost no foreign matter, and it is good quality coal; but as the mining method is the dry earth-fill method, the ash content reaches 16%, perhaps because of an admixture of earth and gravel from the mining. The mining is presently going on down to 130 meters below the surface. Because the upper 60 meters are being mined, the existence of the coal there was confirmed. But, conditions below that cannot be deduced, it was said, because of the almond shape of the deposits.

Coal Quality and Amount of Coal

The coal is the best quality of bituminous coal in French Indo-China. The ash content of the lump coal is about 5%; but since it is soft, most of that extracted is powder coal and has an ash content of over 16%. Its water content is very low, and the volatile elements are around 20%.

B Being the best bituminous coal in French Indo-China, it is used as railway coal and for manufacturing briquettes when mixed with anthracite. Or, again, it is used in small quantities in the manufacture of coke.

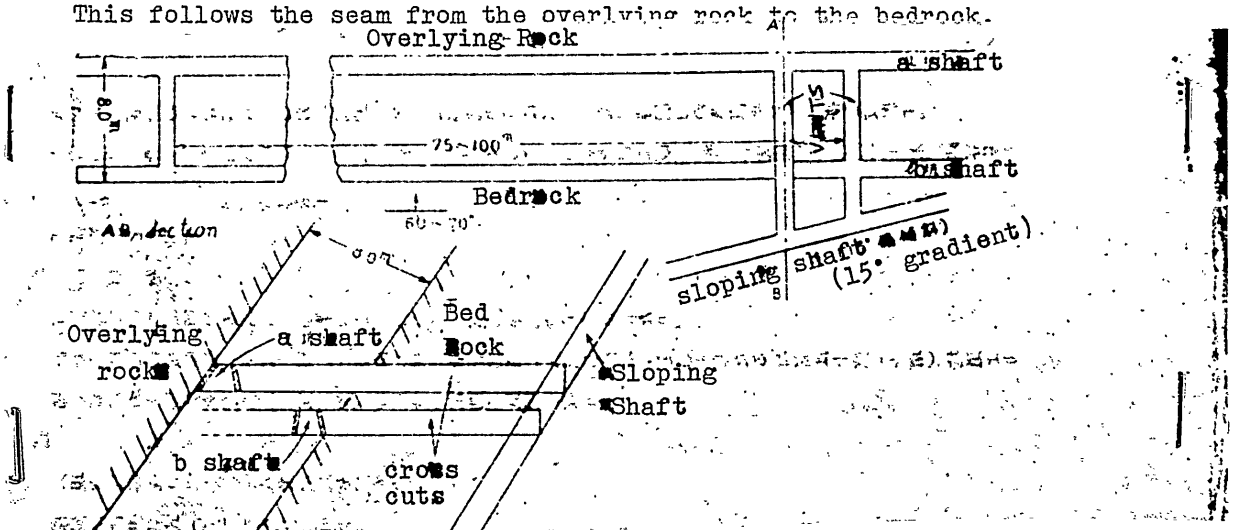
Thus, it is a very useful kind of coal, but the reserves are scant; and even surmising that the coal-seam reserves exist down to 200 meters below the surface, the total reserves do not exceed 4,500,000 tons.

We estimate the present annual coal production at about 40,000 tons so that, regrettably, this mine has a future of only 10 years. Of course, an increase in coal production is clearly most difficult in view of the above facts.

Mining Methods

In the central part of the concession there has been drilled a shaft 3 meters in diameter and 100 meters deep. From the bottom of this shaft there is a sloping shaft with an angle of 15° and extending into the rock for 120 meters. (The end is 130 meters from the surface entrance of the vertical shaft.)

To mine the coal, a very steeply sloping shaft runs down to 160 meters below ground level at the entrance of the vertical shaft. The mining is accomplished by pushing along a small cross-cut shaft beginning 2 meters above the sloping shaft and gradually moving along the coal seam. This follows the seam from the overlying rock to the bedrock.



(Every 70 to 100 meters there is a vent to the surface for ventilation.) The coal is carried in baskets to the coal cars, lowered in a dip cage along the sloping shaft to the bottom of the loading shaft, and then put into the vertical-shaft cage to be taken out of the pit.

As the coal mining gradually moves from the upper to the lower area, the mine tailings and earth from outside are packed in between woven bamboo mats so as to fill up the seams.

Compressed-air coal picks are used in the mining of the coal. (At present, the mining is going on 108 meters down from the pit entrance.)

Ventilation

There are small, vertical air-exhaust shafts equipped with an electric fan capable of moving $26m^3$/second.

The system of ventialtion is through the vertical conveyance shaft, the sloping shaft and into the cross-cuts, introducing air into shafts following the seams. And, the air exhausted from the coal face goes directly through the exhaust shafts - a very simple and adequate system.

Lighting of the Pit

Electric hand torches are used.

Water Drainage

While water seepage normally is slight, the the rainy season it reaches a rate of $300m^3$/hour. So, in the bottom of the vertical and the sloping shafts there are 8 electric pumps of $100m^3$/hour capacity and a total horse power of 660. And, in the mid-point of the vertical shaft there are 3 steam-powered pumps with a total capacity of $600m^3$/hour.

Coal Grading

Near the mouth of the vertical shaft the coal is sieve-separated only into lump and powder coal.

In the lump portion the ash content is around 5%; but possibly because of an admixture of earth and gravel from the fill, the powder coal has a 15% ash content. The volatile elements are around 20%, the sulfur 1.0% plus, so that it is high-grade bituminous coal and is usable as mixing coal in the manufacture of briquettes. Therefore, this is a mine especially designated by the French Indo-China Mining Bureau for receiving special protection.

Transportation

From the mine face to the top of the vertical shaft 0.5-ton coal cars haul the coal (The rail gauge is 0.6 meters.). After sieve-separating, the coal is loaded into 10-ton capacity ore cars (of which there are 35) and hauled to the trans-shipping point over a railway of 0.6-meter gauge rails of 12-ton/meter capacity. The locomotives are 14-ton steam locomotives (4 Baldwin models and 1 Koppel model, for a total of 5), each hauling 6 to 8 cars in a train: mine to generator station - 5 km - to docks (Song Cau) - 14 km.

1. Hoist in sloping shaft
   15 single-chassis electric hoists
   Coal cars moved in dip cage

2. Hoist in vertical shaft
   47 double-chassis elec. hoists
   Moved in double-deck cage

Power

The generator station is thermal powered and is along a road 5 km north-east of the mine. It is equipped with two 700KW "Five Lille Turboo alternaters" [as in text] and three babcock and Wilcox boilers with a total heating surface of 450 square meters. It transmits current at 5,000V.

The Wharf and the Song Cau Canal

Hauling is chiefly from the Mal Cam pit over an 0.6-meter railway to the Song Cau wharf in Thai Nguyen - a distance of 19 km. Along the way at a point 4 km from the Lam Cam pit is the central generator station. The crude coal used for the boilers is unloaded here. The rest is hauled without sorting to the wharf. Sometimes the lump coal is hand sorted. The condition of the rails permits a 12-ton/meter load. Four 14-ton locomotives (Baldwin model) and thirty 10-ton capacity ore cars constitute the rolling stock. The trains are made up of six cars each time, so that the load totals 60 tons (with the pulling capacity being 80 tons). The storage depot at Lam Cam has a capacity of about 9,000 tons; that at Song Cau, about 3,000 tons, for a total of 12,000 tons. The unloading from the ore cars is accomplished by using bamboo baskets. And, at the river bank it is poured through a very simple sheet-steel chute into 150-ton lighters. At present, two chutes are being used. the hourly loading capacity of each chute is 10 tons - for a total of 20 tons.

If the loading continues for 10 hours a day, it will take $1\frac{1}{2}$ days to load a 150-ton lighter. From here the lighters go down to Song Cua, entering the Song Cua canal slightly upstream from the Tac Oun dam. This canal was completed by the French Indo-Chinese Government in 1928. It connects/the Song Cua and Song Thuong Rivers; it has a total length of 53 km abd the difference between the level of the two ends is 21 meters. Of the 8 locks along the way, 2 are harborage locks. The whole of it is

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divided into seven sections. From the upper reaches of the river to the No. 7 lock the drop is 1.24 meters to 2.71 meters; and at the harborage lock at Song Thuong it is about 6 meters. However, being affected by high and low tides, this difference increases and decreases. These locks are French 300-ton models suitable for flat-bottom vessels. Their internal length is more than 50 meters and the wall-to-wall width is 6 meters. The length decreases as one moves from the upstream sections to the downstream sections. In the first channel the width of the water surface is 22 meters, down to a minimum width of 12 meters; and the septh is 3.2 meters. But, these dimensions gradually lessen until the width is 10.6 meters and the depth 2.6 meters at a point 25.6 km along the canal. From here down to Song Thuong the width is 10 meters and the depth is 2.4 meters. Along this canal as far as Phu Lang Thuong thereeis an auto highway; and bridge spans have been constructed at each lock. The largest lighter that can pass through this canal is one of 300 tons, taking two days to navigate the distance. Using human power to pull the ropes from the canal bank, the canal has maximum transporting capacities as follows: Operating 12 hours/day and running a 300-ton lighter through every 30 minutes, the maximum load is 200 tons/day. In one year itnis about 260,000 tons. In view of the number of lighters and the factor of the locks and the necessity for repairwork once a year (at the time of low water), it would be very difficult to increase the number of lighters handled above this level.

The following regulations apply to this canal:

1. When more than two barges or lighters or small boats use the locks together, their passage fee is reduced by one fourth.

2. The categories of goods transported is to be covered by a transportation permit and the loads are to be inspected; if there is any false declaration, this will be prosecuted.

3. All income recorded under these provisions will be under the management of the Tonkin Area Finance Office.

4. Until new decrees are issued by the Government-General, human labor, or oxen and horses shall pull the vessels.

3V

5. The Head of the Office of Financial Management and the Chairman of the Tonkin Board of Directors shall have authority over this jurisdiction.

The fees on the canal traffic are as follows:

(1 in a lock at a time)

Cargo Categories	Small Freight Boats under 50 tons (Junks)	Barges Over 50 tons	Barges Over 300 tons
Empty vessels	1.00 piasters	1.50	2.00
Iron ore	1.50	3.00	5.00
Coal, cement, rice	2.50	4.50	7.00
Zinc Ore	4.50	9.00	15.00
Other freight	7.50	15.00	25.00

Barges loaded with several kinds of freight at the same time will in general pay passage fees for the most highly assessed commodity. The transportation by the Phan-me coal boats is an enterprise of the S.A.C. R.J.C. [sic -?], going down the Song Cua canal to Phu Lnag Thuong. From there it is either shipped on to the Haiphong region or else sent by railway to the Hanoi area.

Now to compute the transportation expenses:

Song Cua pit	Thai Nguyen	To wharf (by narrow-gauge RR)	0.75 piasters/ton

The Coal Storage Depot

The Lang Cam depot can handle 9,000 tons and the wharf area on the right bank of the Song Cau, 3?,000 tons.

Uses of Phan-me Coal

As this is the best bituminous coal within the territory of French Indo-China, it has great importance as a raw material for briquettes and coke. At this company, coke has in the past been manufactured by a 22-ton capacity furnace; but since 1939 this activity has been halted and the bituminous coal has been supplied as a raw material to the Tonkin Coal Mining Company's Hongay Briquette Manufacturing Shop. The amount of coal produced is gradually building up.

Table of Coal Production during Past Ten Years

(Unit: 1000 tons)

1931	1932	1933	1934	1935	1936	1937	1938	1939	1940
30.0	22.7	24.3	17.0	16.3	18.4	22.7	31.7	33.6	39.7

Number of Miners: 1937 - 330; 1938 - 560; 1939 - 652; 1940 - 766.

Section 2. Societe Anonyme des Charbonnages de Tuyen-quang

Company Founded: December, 1924

Capitalization: 1924: 800,000 francs; 1928: 8,000,000 francs

Branch Office: Tuyen-quang (Province de Tonkin)

Main Office: 38, Boulevard Gia-long, Hanoi

Concessions and Area:

		Area (Hectares)		Date set up
Operating Concessions	Alci	240	1,140	Feb. 13, 1921
	Yvonne	900		Apr. 13, 1922
Idle Concessions	Marguerite	900	900	Aug. 5, 1932

Mine Supervisor: M. Bernard

Location, Communications and Topography

This coal mine is outside of the town of Tuyen-quang in Tonkin State, approximately 170 km north of Hanoi, on the flatlands of the River Claire. The extracted coal is loaded from the bank of the River Claire and carried downstream on the Claire and the Rouge to the Hanoi area, where it is supplied against demands for domestic consumption.

Geology and Coal Seams

The coal measures of this mine are said to belong to Tertiary strata. The area of the deposit is much segmented because of faults; the area measures about 1,000 meters by barely 250 meters.

A reverse-thrust fault forms the north-east limit of the coal measures, which abuts palaeozoic limestone strata. The south-west limit also is formed by a fault, again meeting palaeozoic limestone strata. The coal seam here - a single seam - slopes very steeply. But, the other seams are nearly horizontal. Besides the above two faults, there are many small faults, making the mining very difficult. On the north-west end of the concession there is some mining of a partial outcropping; and elsewhere 3 of 5 shafts are being used.

The coal seams have a maximum depth of about 80 meters; their thickness ranges from 5 to 7 meters. The strike is north-west to south-east, forming a continuous syncline. Following along the strike is a reverse fault. In the overlying rock, part of which forms a double syncline, there is oil-shale more than 5 meters thick (This oil-shale is said to have an oil content of 2%.). In the coal seams there are more than ten intrusions of volcanic ash. In the pit there is much gas and a large amount of water seepage. We were told that sometimes operations are interrupted while the crew labors to drain the working area.

Coal Quality and the Amount of Coal

The quality of coal is bituminous, with good burning characteristics. It has an ash content in the lump coal of about 7%; water content is barely 2%; volatile elements are abour 38%. Thus, it has something the characteristics of coking coal. Since it does burn well, it is used to manufacture stoking coal for factories and briquettes for the railways.

Since the area of the coal deposit is restricted, the remaining reserves are about 1,500,000 tons. But, the amount that is mineable is believed to be less than 700,000 tons. And, even with the application of considerable equipment, we believe that in the future the annual production can only be held above 50,000 tons with much difficulty.

Mining Methods

Development of the pit is made possible through vertical shafts - two round ones and two square ones. The round shafts each have a diameter of 3.1 meters and a depth of 64 meters:

Gaiset 1	Abandoned
" 2	Used for ventilation and hauling Equipped with a 14-inch cylindrical steam hoist

The square shafts have a diameter of 1.5 and 3.0 meters and a depth of 45 meters. Each shaft is equipped with an electric ventilator fan with 29 m^3/second capacity.

The pit is located close by the River Claire; and especially in the rainy season there is heavy seepage of water so that during the past 2 or 3 years the danger of flooding in the pit has halted the mining, and they have just been pumping out water.

In February, 1942, while our coal team was conducting this survey, they had just finished draining out the water from the past year's rainy season and were making preparations with the expectation of mining the coal from about May.

At present, on the north-west end of the region there is some coal near to the surface which is being mined, and also an outcropping - both together yielding about 70 tons per day. The square shafts are called the north and the south shafts. They are equipped with ventilator fans, but as the ventilation passages are inadequate, the amount of ventilation is small. The miners assigned to the digging directly are adult men; but young boys and girls have charge of the conveyances.

Water Drainage

In ordinary times 9 m^3/hour; 200 m^3/hour in rainy season

Pump stockpile(Two 100 h.p. / One 49 h.p.) not capable of handling the job

Coal Grading

The coal grading machine is on the bank of the River Claire, performing both sieve-separating and water dressing. The sieve separator is capable of handling 50 tons/hour; the water dresser is a Rheo model with a 10-ton/hour capacity.

Coal under 40 mm goes into the water dresser as raw coal and then is sieve separated.

The categories of refined coal and their production percentages are:

Lump coal	Gros crible	over 40 mm	% Produced - 50%
Small lump	Noisette	40 - [text defective]	" 25%
Powder coal	Menu	Under 8 mm	" 25%

These are commonly used for steam boiler stoking.

Transportation

The coal is carried from the open-cut diggings in bamboo baskets (15 kilogram capacity) slung on poles carried on the shoulders of youths, and is loaded into coal cars (0.5 ton, on 0.6 meter gauge tracks) and sent to the coal-grading shops near the wharf. 8 to 10-ton steam locomotives haul the 15-car trains.

It is 200 meters from the coal-dressing site to the loading wharf. In this space the refined coal is stored by grade, the storage depot capacity being about 5,000 tons.

For loading the lighters there are two 17-meter steel frames set up at right angles to the river and supporting a hoisting crane of 22 h.p. and a moving crane of 3.0 h.p. - both electrically powered. The coal is loaded into 1-ton capacity, side-opening coal boxes, which are moved by the cranes directly over the lighters and opened and emptied; Although the height from the steel frames to the water differs according to the flood or low stage of the river, the overall average is 15 meters.

The hourly loading capacity is said to be 30 tons, but it is probably actually about 15 tons. According to whether the river is high or low, the size of the lighters handled is from 30 tons to 100 tons.

Table of Coal Production during the Past Ten Years (Unit: 1000 tons)

1931	1932	1933	1934	1935	1936	1937	1938	1939	1940
21.0	25.5	10.2	9.8	17.6	17.0	20.3	23.0	20.2	15.4

Number of miners: 1939 - 481 1940 - 444

Section 3. Other Brown Coal

1. Outline

In the Ninh-Binh Province region of Tonkin State there are the three mines, Ninh-Binh, Shi Ne and Phu-nho-guan, but these are actually in the process of being prospected; and all three are idle at present. The neighborhood is heavily overgrown with brush so that even the location of the outcroppings could only be seen for a short distance. There are also the Lang Seng, Cao Bang and Yen-Bay brown coal seams. The Cao Bang is just being drilled, and is beginning to fill some of the requirements for tin smelting, as well as for refractory furnaces or stoking. But, since the areas are limited and are far removed from the places where the coal is needed, they are not yet being worked, with the exceptions noted above.

2. Bassin de Nong-son (Annam)

30 km south-west of the city of Tourane stretches the southwest branch of the Annamese mountain range. The coal seams there are covered by alluvial strata, and they also are exposed. This coal field measures 15 x 8 km, with semi-anthracite resembling that of Hongay. In the Bassin de Nong-son, 75 km west of Tourane city, is the Nong-son coal mine, along

the Song-Thu-Bon River. And, 50 km west of the city, on the bank of the Song-Vu-Jia River is the Vinh Phuoc coal mine. Both are mined by pick.

Nong-son Coal Mines

The Nong-son mines produced 300,000 tons of coal between 1900 and 1920. Both coal mines have 3 to 5 seams of coal; but the geology is very erratic and twisted; and the quality and amount of coal are poor. The geographical conditions are so bad that the developmental activities are accompanied by all sorts of difficulties. Thus, regular coal-mining operations cannot be undertaken, and the work is gradually diminishing, though still going on today.

Neither of the mines has an annual production of as much as 200 tons. The coal is taken to the "Cashi Dai" [phon. approx.] spinning mill and to Tourane city in 4 to 8-ton capacity lighters.

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CHAPTER 4

VIEWS ON THE COAL OF FRENCH INDO-CHINA

(and Supplement: Concerning the cement and carbide industries of French Indo-China)

1. Anthracite

Onnthe west shore of the Bay of Along runs the belt of the Quang-yen coal seams which are the anthracite fields of French Indo-China. When we take into account the geographical conditions, the coal quality, the amount of coal, the state of current operations and the situation of the companies at the various coal mines being developed, we reach the considered opinion that non have a rich future ahead of them, except for the two big coal mines of Hongay and Dong Trieu. Nor do we feel that, except for the Along et Dong Dang Company, any of the small coal mines can lift themselves out of the category of pick-axe mining - which may be seen in our country, too; nor do we believe that they warrant any attention.

The two big companies, first of all the coal mines, had their connection with the French homeland broken with the outbreak of World War II, and they have lost hope of receiving capital goods (chiefly machinery and tools) from the homeland and other European countries. And, with the shortage of labor, the maintenance of production peaks has to be tirelessly sought after. Further, they are faced with considerable difficulty in even continuing past operations. And, they harbor earnest hopes for the restoration and expansion of their markets. By giving urgent attention to balancing production and consumption, they hope to rationalize their enterprises. To this end, they are reconsidering capital goods from our country, of course including ore freighters. Noting the present situation in which our country is sending many technicians to the southern regions except French Indo-China, we feel that, judging from operating conditions, thereiis no need for our country to manage French Indo-Chinese coal - barring special conditions arising. Also, even from the standpoint of the workers' conditions, it will probably be all right to leave things as they are.

The following is a general summary of the important coal mining companies.

1. S. F. C. T.

This coal mining company produces 70% of the anthracite mined in French Indo-China and can be called the first in the Orient. Its anthracite is quite hopeful both for quantity and for quality. The amount of its coal reserves is 300,000,000 to 400,000,000 tons. (French Indo-Chinese authorities say it is 10,000,000,000 tons; Mr. Kingoro Uchida of the Government-General of Chosen has said 1,200,000,000 tons.) Not only is it suitable for the manufacture of coke for use in steel production because of its low content of volatile elements, richness in solid carbon and especially because of a sulfur content of less than 0.8%, but also it is indespensable in the manufacture of briquettes for use in such chemical industries as the soda industry or the carbide industry. This anthracite is the chief source of supply for our country, which is not favored with such a quality or quantity of anthracite. It is said now to be an inexhaustible supply; and it is not inferior to any degree to the North Chinese Yang-Ch'üan coal which is receiving so much attention. We offer for consideration the following table of industrial analysis:

Comparative Table (Percentages) of Industrial Analysis of Hongay Coal
Hongay Coal and Yang-Ch'üan Coal

	Water Content	Ash Content	Volatile Elements	Solid Carbon	Sulfur	Caloric Value	Notes
Hongay Coal (Avg of 7 varieties)	2.07	2.01	7.03	88.94	0.51	8,352	Coal Mission Sample
Yang-Ch'üan Coal (Avg of 4 kinds)	1.60	4.86	8.45	84.83	1.08	8,003	Analysis by S. Manchurian RR Co.

For our industrial world, which has been depending on imported anthracite, the devising of a plan for importing large amounts of French Indo-Chinese coal would be a big aid in achieving the immediately urgent industrial production increases.

Again, when considered from the standpoint of the technology of coal mining, the Hongay coal mines are not favored geologically, having faults and folds so that the strikes are broken up. In the future when

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pit mining of the deeper parts is undertaken, various kinds of difficulties can be expected. Along with this, we feel that the future seasoning of the unskilled Annamese laborers for supervisory assignments will require very considerable application of effort by the various kinds of labor management.

The atmosphere of the supervisory office of this mining company in general reflects an uncompromising, arrogant attitude, completely secretive from beginning to end.

2. S. C. D. T.

This coal company, producing 20% of the anthracite in French Indo-China is inferior to the S. J. C. T. in amount of coal, but is possesses an area of projected development in the north so that there is no anxiety about its future. As for the quality of its coal, its importance lies in the lower content of volatile elements and the lesser amount of ash than in the so-called Hongay coal, as well as from its utility for producing electrical power, in making electrodes and as a raw material in the carbide industry.

Viewed from the standpoint of mining technology, the same kind of points can be raised as with the S. J. C. T.; and particularly, compared to the S. J. C. T., it probably has an advantage in simpler geologic structure.

The whole supervisory staff of the S. C. D. T. is very earnest about improving the enterprise and displayed a co-operative attitude toward us under the emergency situation. They emphasized that if sufficient concern can be generated in our countrynfor the market, they will match it with considerable efforts.

3. Along et Dong Dang Coal Mining Company and the Tambour Mine

The concessions owned by this mining company are on the lowland bordering on the Bay of Courbet, and it follows after the S. C. D. T. in present production maxima. But, judging from the quality of its coal and the quantity, it has poor possibilities. And, from the point of relative favorableness of geographical conditions, it is now no more than just barely carrying on.

4. Bituminous Coal

At present bituminous coal is only being mined at the Phan-me and Thuyen-can mines. Neither of these two mines are promising in quantity or quality of coal; and though it would not be difficult to achieve some increase in their coal production, they cannot move ahead any faster than does the demand within French Indo-China.

Also, as for the coal team, we have hope for bituminous coal as being especially favorable for use in developing transportation in the South French Indo-China region and for use in stoking along the coasts. But, if unfortunately that hope is not realized, it would be regrettable from the standpoint of our country's national defense. The southern region in general is a region developed from Quarternary strata. In the territory of New Thailand near the southern border there are coal deposits of some promise, but for the present there is no way to do anything about them.

Besides, these, there are the coal fields of Phu-nho-quan (Ninh-Binh Province) and Dien-Bien-Phu (Lai-Chau Province, 300 km west of Hanoi), but we do not consider that they have value for development now because of such matters as transportation, etc.

APPENDIX

ON THE CEMENT AND CARBIDE INDUSTRIES OF FRENCH INDO-CHINA

In French Indo-China, limestone, a basic ingredient for the cement, carbide and glass industries, is spread over practically the entire map. A major area for it is the north part of Tonkin State, especially the drainage basin of the Red River (Rivier Rouge). These limestone strata, which belong to the Palaeozoic era, also extend into the Bay of Along where they form the islands and capes, and by natural erosion assume a myriad of shapes and forms - these unusual sights constituting beautiful scenery of much fame in the Orient. Also, it is distributed in the Battambang and Kampot areas of western Cambodia and in Ha-Tien of Cochin China. These limestone-rich regions constitute the source of supply of this raw material for the cement and carbide industries. Year by year the production of the Portland cement factories and glass factories in Haiphong has climbed to new levels.

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Our coal team pushed forward its survey during the last part of January, 1942, in a 15-km zone in north Quang-yen, Quang-yen Province, Tonkin State; and in the short period of three days, in a very restirticted area of prospecting, arrived at the ~~following~~ conclusions, which we have tried to summarize below.

In the various kinds of manufacturing industries noted above where limestone is a raw material, and an abundant supply of coal and electric power is an absolutely esstential condition. Fortunately, in French Indo-China limestone is extraordinarily abundant; and, according to the results of the simple analysis given on a separate sheet, we found that tests of 225 samples showed 85% of the samples having a calcium carbinate content of over 90%. As for obstacles to carbide manufacturing because of the admixture of such impurities as Magnesium carbonate, iron oxide and silica, again from detailed chemical analysis we could of course conclude that French Indo-China must be said to be favored by conditions making for the easy use of an abundant supply of good-quality limestone.

The coal used as a raw material in this manufacturing already has be carefully discussed in the foregoing chapters about Hongay coal, Dong Trieu coal, etc. This coal, found in large deposits in the are of coal distribution, is a very convenient supply. Unfortunately, getting around to electric power, this domain is poor in electrical-energy sources, the prime ones being the Mekong and Rouge Rivers. And, though there is an abundance of water and swiftly flowing streams and rivers, under present conditions all electrical power depends upon thermo-electrical generation. And, the consumption of electrical energy for industrial uses is in insignificant amounts. Therefore, the enterprises needing the development of electric power are not just these of the carbide industry but are all types of industries expected from now on. And, we expect that these hydro- various industries will provide the motive power for the development of such power sources.

The chemical industries in French Indo-China now using limestone as a raw material - as well as the other industries, too - are distorted in many ways policy-wise, and are being kept immature technologically, so that there are none which need to be looked into to check their present condition. Therefore,

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Therefore, French Indo-China, which must hereafter play a very big role as one wing of the Greater East Asia Co-Prosperity Sphere, must quickly develop is electrical power enterprises and must exert such effort in that area as will clear away the obstacles to the development of chemical industries.

[Tables of Analysis of Coal and Limestone are Appended]

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TABLE OF ASSAY ANALYSIS RESULTS FOR THE COAL OF FRENCH INDO-CHINA

Laboratory, Japan Coal Company, Ltd.

Pit Name	Coal	Date Sampled	Date Tested	Water	Ash	Volatiles	Solid Carbon	Sulfur	Caloric Value	Fuel Value	Type Coal	Color of Ash
Hatou pit	Main seam	Jan. 12	May 18	1.65	2.12	9.00	87.23	0.35	8,340	9.69	Non-coking	Gray (purple)
" "	Middle seam	"	"	2.00	2.16	7.15	88.69	0.55	8,350	12.40	"	Gray-red-brown
"	Open-cut digging	"	"	1.93	0.90	8.10	89.07	0.47	8,479	11.00	"	"
"	" "	"	May 19	1.54	1.14	8.58	83.74	0.41	8,537	10.34	"	"
Halam pit	Coal face	Jan. 13	May 21	2.13	1.17	7.19	89.51	0.46	8,447	12.45	"	"
Halam pit		"	May 18	1.96	0.98	7.28	89.78	0.54	8,461	12.33	"	"
Halam Open-cut	Upper seam	"	"	1.58	2.37	9.70	86.35	0.63	8,341	8.90	"	"
Can Hua Open-cut	Upper seam	"	"	1.05	2.20	4.73	91.14	0.43	8,315	19.27	"	Gray-wht (brown)
Can Hua	Upper seam	"	"	2.22	2.61	6.18	88.99	0.36	8,200	14.49	"	"
"	"	"	May 24	2.39	1.88	6.87	88.86	0.63	8,359	12.93	"	Milk white
"	Middle seam	"	"	1.60	19.60	9.58	69.22	0.90	6,654	7.23	"	Gray-black
"	Lower seam	"	May 11	6.60	4.30	14.59	74.51	0.36	7,079	15.24	"	Gray-white
"	"	"	"	1.89	3.01	6.06	89.04	0.49	8,198	14.69	"	Gray-wht (brown)
"	"	"	"	1.53	15.26	5.83	77.38	0.36	7,121	13.27	"	Green
Can Hua	Open-cut digging	"	"	2.21	52.78	7.88	37.13	0.32	3,504	4.71	"	Gray-wht (green)
"	"Moya" coal	"	"	3.00	3.12	5.95	37.93	0.87	8,185	14.78	"	Gray-orange
"	"Boya"	"	May 18	1.95	12.57	6.35	97.13(sic)	0.67	7,282	12.46	"	Gray-red
Can Hua Port	Storage Depot	Jan. 14	"	3.20	5.89	7.86	83.08	0.54	7,753	10.57	"	Gray-wht (red)
"	"	"	"	2.09	2.98	6.29	88.64	0.62	8,264	14.09	"	Gray-wht-purple
"	Storage, water-dressed	"	"	5.50	12.85	12.77	68.88	0.61	6,537	5.39	"	Gray-red
Mon Dhuong Pit		"	"	2.09	1.46	6.60	89.85	0.56	8,380	13.61	"	Gray/red-violet
" "	Medium lump	"	May 14	1.89	4.92	7.20	85.99	0.68	8,086	11.94	"	Gray-wht (purple)
" "		"	"	2.40	4.11	6.21	87.28	0.71	8,089	14.05	"	Gray-wht (red)
" "	Carts at bottom pit	"	May 15	2.08	2.44	7.40	88.08	0.64	8,291	11.90	"	Gray/brwn-purple
Hongay	Coke	Jan. 12	May 10	1.73	13.58	3.10	81.58	1.18	6,784	26.32	Coking	Purple (red)
Hongay	Briquette	"	May 25	2.51	7.57	17.93	72.19	0.84	7,759	4.03	"	Gray-red (brown)
Mao-Khe	Within pit	"	May 16	4.90	5.09	5.77	74.24	0.61	7,708	14.80	Non-coking	Gray/brwn-purple
"	A Seam	Jan. 29	"	4.46	18.61	5.17	71.76	0.53	6,360	13.83	"	Gray-brown
"	B Seam	"	"	4.85	20.57	5.67	69.91	0.54	6,254	12.15	"	Milk white
Cipier Pit		Jan. 31	"	2.42	4.27	8.17	85.14	0.44	8,146	10.42	"	Milk white (red)
"		Jan. 13	May 22	1.78	1.07	8.45	88.70	0.43	8,450	10.50	"	"
"		"	"	1.70	5.57	8.34	84.39	0.58	8,060	10.12	"	Dark gray
"		"	"	1.66	6.40	10.22	81.72	0.48	7,792	8.00	"	Gray-orange
Dong Trieu	Second seam	"	May 27	5.27	5.04	6.31	83.38	0.97	7,218	18.21	"	Purple (red)
"	Fifth seam	Jan. 26	May 13	4.89	1.10	4.10	89.91	0.47	7,936	21.93	"	Gray-red
"	6th seam, upper	"	"	5.41	2.35	3.64	88.60	0.69	7,615	24.34	"	Gray-wht-red
"	6th seam, lower	"	May 11	5.52	5.89	4.79	83.80	0.67	7,259	17.49	"	Gray-white
"		Jan. 30	May 20	5.29	8.09	4.82	81.30	0.87	7,103	16.97	"	Gray-brwn-purple

Dong Trieu	From pit	Jan. 27	May 24	4.98	7.50	2.78	84.74	0.57	7,222	30.48	Non-coking	Pale red-violet
Dong Dang	Open-cut digging	Jan. 13	"	3.03	8.79	10.91	77.52	0.57	7,490	7.81	"	Gray-purple
Dong Trieu		"	" "	5.54	2.55	4.20	87.71	0.69	7,547	20.88	"	Purple (red)
Dong Trieu	Washed small lump	"	"	5.02	6.93	6.22	82.83	1.16	7,169	15.87	"	Purple
Albert Pit		Jan. 17	May 13	2.69	18.39	8.77	70.15	0.66	6,616	8.00	"	Brown-purple
Neptune Open-cut	Lump coal	"	May 21	2.12	1.98	8.66	87.24	0.43	8,308	10.07	"	Gray-wht (red)
" "	Fine powder	"	"	1.79	5.58	7.92	84.71	0.34	8,004	10.70	"	Gray white
Tambour south pit	Good powder	"	" "	2.18	9.93	9.17	78.72	0.53	7,517	8.58	"	Gray-wht (red)
" north pit		"	"	1.52	3.68	8.24	86.56	0.56	8,230	10.50	"	Gray-wht (purple)
"		"	May 19	1.62	11.65	9.05	77.68	0.65	7,437	8.58	"	Pale red-violet
"	Lump coal	"	"	1.54	4.55	8.69	85.22	0.56	8,169	9.81	"	Gray-brown
" south pit	Poor coal	"	"	2.16	39.16	8.24	50.44	0.33	4,625	6.12	"	Gray-wht (brown)
Cai Da B pit	Open-cut digging	"	"	1.93	3.56	6.25	88.26	0.58	8,183	14.12	"	Gray-wht (red)
Bicho	T seam	Jan. 28	"	3.78	2.22	6.86	87.14	0.59	8,194	12.70	"	Dark brown (red)
"	"	"	"	3.21	4.60	5.54	86.65	0.85	7,895	15.64	"	Clear brown
Bicho port	Powder coal	"	"	3.72	15.65	5.23	75.40	0.65	6,766	14.42	"	Red-gray (brown)
Chacha 3rd pit	A seam	Jan. 31	May 8	5.67	6.91	4.96	82.46	0.62	7,417	16.63	"	Light brown
" 8th pit	A seam	"	"	1.84	9.84	25.69	62.63	2.91	7,573	2.44	Strong cokg	Deep violet (red)
Co Kenh	upper	Feb. 2	"	5.61	4.39	5.97	84.03	1.04	7,465	14.08	Non-coking	Pale red
"	lower	"	May 19	5.08	3.70	4.32	86.90	1.30	7,482	20.12	"	Deep violet (red)
"	outside of pit	"	"	5.17	16.48	4.74	73.61	2.09	6,370	15.53	"	Gray/red-violet
Phan-me	(Lang Cam pit, 106-meters)	"	May 8	4.99	4.14	3.74	87.13	0.53	7,685	23.30	Strong cokg	Pale red-brown
"	(" "	)Feb.6	"	1.82	4.03	25.23	58.92	1.93	8,136	2.73	"	Deep purple-brown
"	Loading point	Feb. 10	"	1.43	19.15	23.62	55.80	1.00	6,741	2.36	"	Gray purple
"	(Idle pit, semi-anthra-cite)	"	"	2.07	3.30	10.47	84.16	2.44	8,137	8.04	"	Deep violet (red)
Tuyen Quang pit	2nd seam	Feb. 9	"	4.14	7.82	38.61	49.43	1.12	7,070	1.28	Coking	Tan (red)
Tuyen Quang	Outside pit	"	"	4.60	6.72	39.86	48.82	3.17	7,080	1.22	Weak coking	Deep violet (red)
Vinh Phuoc	No. 1 pit	"	May 23	2.72	47.66	7.55	42.07	1.25	3,864	5.57	Non-coking	Red (brown)
" "	Storage depot	Feb. 23	May 23	4.81	40.60	10.71	43.88	0.52	4,151	4.10	"	Pale red
Nong Son No. 1		Feb. 22	"	10.99	8.53	23.48	51.00	1.23	4,753	2.17	"	" " (brown)
" " No. 1 - storage depot		Feb. 23	"	3.72	5.85	4.74	85.69	2.52	7,761	18.08	"	Gray-violet (blk)
" " No. 2		"	"	3.84	18.34	6.35	71.47	8.68	6,525	11.26	"	Pale violet

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ASSAY TABLE OF FRENCH-INDO CHINA COAL

(With quicklime content computed from % Calcium carbonate and % Quicklime)

Sample No.	% Quicklime	% $CaCO_3$	Sample No.	% Quicklime	% $CaCO_3$	Sample No.	% Quicklime	% $CaCO_3$
1	53.26	94.9	37	55.16	98.4	73	56.00	100.0
2	54.42	97.1	38	55.30	98.7	74	55.53	99.1
3.	54.65	97.5	39	55.10	98.3	75	55.53	99.1
4	33.89	60.5	40	54.95	98.1	76	54.77	97.8
5	33.33	59.5	41	55.30	98.7	77	54.88	98.0
6	50.22	89.6	42	55.16	98.5	78	55.33	98.8
7	34.35	61.6	43	55.23	98.6	79	55.55	99.1
8	33.55	59.9	44	55.23	98.6	80	55.44	99.0
9	54.50	97.3	45	54.60	97.5	81	55.27	98.6
10	52.68	94.0	46	53.20	95.0	82	55.33	98.8
11	54.76	97.7	47	54.67	97.6	83	55.50	99.1
12	54.71	97.6	48	54.74	97.7	84	36.74	65.6
13	54.76	97.7	49	54.81	97.8	85	54.88	98.0
14	54.75	97.7	50	54.46	97.2	86	53.76	96.0
15	53.66	95.8	51	55.50	99.1	87	54.66	37.6
16	54.53	97.3	52	51.63	92.1	88	55.27	98.6
17	55.04	98.2	53	55.22	98.6	89	55.33	98.8
18	55.21	98.5	54	48.33	86.3	90	55.22	98.6
19	54.81	97.8	55	42.11	75.1	91	55.05	98.3
20	54.52	97.3	56	32.65	95.8	92	55.38	98.8
21	54.72	97.7	57	55.50	99.1	93	55.27	98.6
22	55.09	98.3	58	55.44	99.0	94	55.44	99.0
23	55.21	98.5	59	47.82	85.3	95	55.38	98.8
24	55.32	98.7	60	55.33	98.8	96	42.90	76.6
25	48.63	86.8	61	55.16	98.5	97	55.22	98.6
26	52.25	93.3	62	55.05	98.3	98	55.55	99.1
27	53.93	96.3	63	55.27	98.6	99	51.97	92.8
28	54.88	97.9	64	54.94	98.1	100	54.99	98.1
29	55.02	98.2	65	54.77	97.8	101	55.13	98.4
30	54.77	97.8	66	54.66	97.6	102	55.13	98.4
31	54.88	97.9	67	37.53	67.0	103	55.09	98.3
32	55.33	98.8	68	55.12	98.4	104	55.06	98.3
33	53.79	96.0	69	54.70	97.6	105	55.30	98.7
34	54.74	97.7	70	55.76	99.5	106	42.60	76.0
35	55.37	98.8	71	55.82	99.6	107	54.60	97.5
36	54.95	98.1	72	55.53	99.1	108	53.63	95.7

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Sample No.	% Quicklime	% $CaCO_3$	Sample No.	% Quicklime	% $CaCO_3$	Sample No.	% Quicklime	% $CaCO_3$
109	43.87	78.3	152	55.01	98.2	195	55.11	98.6
110	33.85	60.4	153	54.78	97.8	196	55.88	99.8
111	55.13	98.4	154	54.43	97.1	197	55.53	99.1
112	42.62	76.1	155	45.02	80.3	198	56.00	100.0
113	49.78	88.8	156	54.90	98.0	199	55.53	99.1
114	42.37	75.6	157	54.90	98.0	200	55.65	99.3
115	29.80	53.2	158	55.13	98.4	201	55.76	99.5
116	54.60	97.5	159	55.19	98.5	202	55.76	99.5
117	32.38	57.8	160	54.72	97.7	203	55.29	98.7
118	48.72	87.0	161	54.49	97.3	204	56.00	100.0
119	55.10	98.3	162	55.13	98.4	205	55.53	99.1
120	54.40	97.1	163	54.84	97.9	206	56.00	100.0
121	54.80	97.8	164	55.13	98.4	207	55.05	99.3
122	37.37	66.7	165	48.11	85.9	208	52.00	92.8
123	55.20	98.5	166	55.07	98.3	209	53.65	95.8
124	55.90	99.8	167	55.19	98.5	210	55.88	99.7
125	55.00	98.2	168	55.35	98.8	211	55.43	98.9
126	54.67	97.6	169	55.13	98.4	212	55.36	98.8
127	54.85	97.9	170	55.48	99.0	213	55.45	99.0
128	54.96	98.1	171	54.90	98.0	214	55.71	99.4
129	54.56	97.4	172	54.90	98.0	215	55.99	99.9
130	54.30	96.9	173	55.25	98.6	216	55.78	99.6
131	54.56	97.4	174	54.84	97.9	217	55.57	99.2
132	54.58	97.4	175	53.15	94.9	218	55.85	99.7
133	54.18	96.7	176	55.10	98.3	219	55.28	98.7
134	55.10	98.3	177	46.70	83.3	220	55.45	99.0
135	54.61	97.5	178	55.44	99.0	221	55.72	99.5
136	54.58	97.4	179	48.94	87.3	222	55.05	98.3
137	52.53	93.8	180	51.02	91.1	223	34.29	61.2
138	54.02	96.4	181	44.52	79.4	224	34.64	61.8
139	54.96	98.1	182	33.77	60.3	225	55.57	99.2
140	54.73	97.7	183	34.10	60.9	226	55.85	99.7
141	55.09	93.3	184	51.80	92.5	227	55.28	98.7
142	53.37	97.0	185	53.87	96.0	228	55.45	99.0
143	54.70	97.6	186	49.39	88.1	229	55.72	99.5
144	54.87	97.9	187	54.77	97.8	230	55.05	98.3
145	54.97	98.1	188	55.44	99.0	231	34.29	61.2
146	54.36	97.0	189	55.60	99.3	232	34.64	61.8
147	54.82	97.9	190	55.89	99.8	233	55.57	99.2
148	54.73	97.7	191	55.44	99.0	234	55.57	99.2
149	54.90	98.0	192	55.55	99.1			
150	38.97	69.5	193	55.77	99.6			
151	54.78	96.8	194	54.40	97.0			

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PART II

IRON AND MANGANESE

CHAPTER I

INTRODUCTION

Written by team member:

Jiro Oe, Technician
Taiwan Government-General

Section 1. Preface

The Iron and Manganese Team of the French Indo-China Natural Resources Survey Mission landed at Haiphong, French Indo-China on November 8, 1941. Up to the time of their departure from Haiphong on March 25, 1942 - five months later - they covered the whole region of French Indo-China in carrying out a survey of iron and manganese deposits. There were 12 team members: 6 regular members, 5 attached members and 1 interpreter. To increase the efficiency of the team during the limited survey period, the team was split into three groups - A, B, and C - each one in charge of a particular area for making its survey. Ilmenite was not initially the responsibility of this team, but because of the staff and other circumstances, the team was the one to carry out a survey of this ore.

A Group

Group member	Jiro Oe (Taiwan Government General) - Geology & Ore - Group leader
Group member	Shigetake Yoshihara (Taiwan Development Co.) - Mining & Development
Group extra	Katsumi Hamamoto (Taiwan Government General) - Measurements
" "	Kakuichi Igawa (Taiwan Development Co.) - Mining and measurements
Interpreter	Itsusaburo Nagata

B Group

Group member	Masaji Saito - Geology and ore
" "	Chozo Sugiyama - Mining and Development (Drafted by Army after outbreak of the Greater East Asia War)
Group extra	Tokimune Kagami - Measurements
" "	Tomoe Motomura - Assistant for measurements
Interpreter	(Hired locally on a temporary basis)

C Group

Group member	Koichi Fujimura - Geology, Ore and Mining
" "	Masutaro Kato - " " "
Group extra	Kazuo Omori - Measurements
Interpreter	(Hired locally on a temporary basis)

Area of Survey

Considering the period of the survey and the difficulty of access of such areas as Lao Cay, the survey was not all smooth going. So, even when, for example, there was a considerable amount of ore but when transportation was too difficult, we have excluded the area from the survey in favor of concentrating on those with important possibilities for development.

A Group

Iron ore reserve area, Thai Nguyen, Tonkin State

Phnom Dek mine, Cambodia

Iron ore deposits, Balna Archipelago, Cochin China

B Group

Iron ore of the Red River basin, Tonkin State

Manganese ore, Cao Bang region, Tonkin State

Ilmenite ore, Cam Ranh Bay and Sam-son coast, Annam

C Group

Iron ore, Thanh Hoa area, Annam

Iron and manganese ore, Vinh area, Annam

Iron and manganese ore, Hue, Tourane area, Annam

Section 2. Iron Ore and Manganese Ore Deposits of French Indo-China

The iron ore deposits in French Indo-China are located from the neighborhood of the China border in the north to the islands and capes of the Gulf of Siam in the South, and they extend across the states of Tonkin, Annam, Lao Cay, Cambodia and Cochin China. But, the main deposits are in Tonkin and Annam, concentrated in North French Indo-China. In South French Indo-China there are only the Phnom Dek mine and the deposits in the Balna Archipelago of Cochin China. The Phnom Dek has a very considerable amount of ore of very good quality and has been widely known for some time. But, geographical conditions are not advantageous, blocking any rapid development. In Lao Cay, iron ore deposits have been reported in a number of places, but they are located far from the sea and harbors; and there are no navigable rivers reaching that far. There are no data proving conclusively that the ore deposits are large; and because of the limited time available, this could not be surveyed this time.

The deposits in Tonkin State are protected by the Government of French Indo-China and are in the Thai Nguyen region; and there are some on the right bank of the Rivier Rouge, following along the course of the river. These, together with with deposits centered on the vicinity of Tuyen-quang, form three distinguishable regions. The iron ore deposits located in these three regions follow the geological structure, each forming belts of iron ore deposits.

Those of the Thai Nguyen region mostly belong to metasomatose ore deposits formed from sandstone and shale of the Devonian period of the Palaeozoic era, or of the Rhatien system of the Mesozoic. Ore such as that formed partly from adjoining ore deposits is mostly composed of hematite. When it is accompanied by limonite, as in the Yvonne deposit, it is chiefly formed from magnetite. This is true of the ore deposits of Yvonne, Dhai Khai, Jeannette, Mo Linh Nam and Lang Hi, all of these having a considerable amount of ore, though such a large ore deposit as the newly discovered Lang Hi deposit, with almost 20,000,000 tons of ore, seems to be rare.

Those ranged on the right bank of the Red River from Lao Cay near the China border all the way to the Hanoi area - 300 km away - include the Ba

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the Ba-xat, Bao Ha, Kien Lao, Thanh Ba and Tang Ma ore deposits. These are metamorphic rocks formed from adjacent ore deposits or metasomatose ore deposits intruding into rocks of the Devonian period of the Palaeozoic or into old crystalline schist. This ore is mainly hematite and magnatite. In general the deposits are not large, the biggest amounting to some 30,000 tons.

Those on the left bank of the Rivier Rouge center on Tuyen-quang and are located at Cu Van and the systems related to it. They are metasomatose ore deposits formed from the products of wind erosion on the sandstone and shale of the Silurian period of the Palaeozoic era. They are, then, made up of hematite and magnetite in slightly larger deposits - nearly 100,000 tons - than those on the right bank.

The iron-ore deposits of Annam begin in the vicinity of Thanh Hoa, near to Tonkin State, and are distributed through Vinh and Hue, south to Tourane, ranging along several hundred kilometers near to the sea on a north-west to south-east line. Most of it occurs in residual secondary exposed ore deposits that originated from crystalline schist and other rocks of the Carboniferous and Devonian periods of the Palaeozoic era. Nearby are granite and other igneous rocks, but we have not yet confirmed the occurrence of metamorphic ore deposits in original, primary contact. Consequently, the small scale of the deposits means that those amounting to several tens of thousands of tons are considered big ones.

The manganese ore deposits are in the north-east part of Tonkin State near to the China border. Those in the Cao Bang region are quite well known, these being stratiform deposits originating from Palaeozoic limestone rocks that are well developed in this region. The deposits falling within the single belt in this vicinity are generally small scale; the important parts are estimated to total about 15,000 tons.

The ore is made up of hard manganese ore, soft manganese ore and other oxidized manganese ores; and it is of very good quality.

Appendix - The ilmenite ore on Cam Ranh Bay and the Sam-son coast of Annam is a sandy ore. That on Cam Ranh Bay has almost no magnetite mixed in, but is of good quality. That along the Sam-son seacoast contains magnetite, requiring the use of a magnetic ore selector. The deposits of both producing areas are quite small scale and are like mere local petty producing areas in French Indo-China.

Section 3. Conclusions

The important iron ores in French Indo-China are in Tonkin and Annam. The Phnom Dek iron mine in Cambodia is noteworthy for the quantity and quality of its ore, but geographical conditions obstruct preparations for its development.

The iron-ore deposits in Annam mostly belong to secondary, exposed residual ore deposits and are not large scale. The best of them reach a size of 20,000 to 30,000 tons. However, they are situated not far from the seacoast and thus have the advantage of being transportable down the navigable rivers. Since the ore is also accompanied by manganese, if there is a way to handle loading of the lighters during the season of the monsoon winds the iron ore could be transported from the Tonkin area to Japan; and this area would be worth considering for assistance in extracting the iron ore. And, this would make possible a policy of technical aid and supervision to the Annamese holders of the mining rights.

The iron ore deposits of Tonkin State are separated into three areas: the Thai Nguyen Reserve Area and the right and the left banks of the Red River basin. But, the Thai Nguyen Reserve Area, which is valued as a reserve for the exlusive use of the motherland's navy, is the one most deserving of notice. At present, the Mo Linh Ham, Jeannine and Yvonne are the three operating mines; but notwithstanding the short period of the survey the new iron mine of Lang Hi, with 20,000,000 tons of ore, was discovered. From Lang Hi to Yvonne the region, with its inner northern area, is one fully deserving of a close mining survey. The French Indo-Chinese authorities say that the ore reserves of this reserve area amount to 100,000,000 tons; but we cannot but believe that this far over-states the facts. We hope that a permanently resident survey organization will be set up in French Indo-China hereafter to carry out an organized, thorough geological survey of this region as its first order of business. From the results of this survey, we consider it to

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be essential that we demand this whole region as a major supply area for iron resources, and that it be thrown open and turned over to our country.

The Lang Hi iron mine could thereafter be leased to the Taiwan Development Company's subsidiary, the Indo-China Mining Company, obtaining approval for this from the French Indo-China Government. Immediately thereafter the present plan for obtaining 1,000,000 tons of ore from French Indo-China through the Taiwan Development Company's mining operations at the Mo Linh Nam and Heannine iron mines would be fully assured of success by the addition of Lang Hi. We would hope that, having acquired the materials and putting out vigorous efforts with coolies for exporting the goods, we could realize the plan for 1,000,000 tons of ore without delay - thus doing much to relieve the pressing iron-ore situation.

The iron-ore on the right bank of the Red River is all insignificant and does not merit our attention; so only that in the region of Tuyen-quang on the left bank needs to be looked into.

The manganese runs counter to the expectations we gained from Cao Bang, being small-scale deposits far removed from the transportation routes to the sea, thus lacking any value for positive development. If the plans are to open this up under the emergency situation, it will require special consideration.

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CHAPTER II

THE IRON ORE DEPOSITS OF THE THAI NGUYEN RESERVE AREA

Survey Period January, 1942

Survey by A Group, Iron & Manganese Team

Group member	Jiro Oe, Technician, Taiwan Government-General
Group member	Shigetake Yoshihara, Taiwan Development Company
Assistant	Katsumi Hamamoto
Assistant	Kakuichi Igawa
Interpreter	Itsusaburo Nagata

Survey Itinerary

	Region of Survey
November 28, 1942*	Leave Hanoi, arrive Thai Nguyen
November 30	Mo-Linh-Nam and Jeannette mines
December 10	Effecting the Survey
December 10	Lang Hi Survey
December 13	Dhai-Khai Survey
December 14	Lang Hi Survey
December 15	Dhai Khai Survey
December 16	Jeannette Survey
December 17	Lang Hi Survey
December 18	Yvonne Survey
December 19	Same
December 20	Phan-me and Nui-Trang-Hoc Survey
December 21	Survey of 6-ton iron ore depositin front of Cu-Van
December 22	Cu-Van Survey
December 26	Leave Thai Nguyen, arrive Hanoi

Section 1. Preface

The A Group of the Iron-Manganese Team conducted the survey of the iron ore in the Thai Nguyen Reserve Ore Area, looking into eight iron ore deposits, of which four - Mo-Linh-Nam, Jeannette, Yvonne and Cu-Van - are established concessions, the first three presently being worked and the last now idle after having been worked previously. Of the remaining

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four, the Dhai-Khai was previously registered as a concession, but has been worked only slightly. The other three are out-and-out discoveries of this present survey, which confirmed their existence. Of the mines now being worked, the Mo-Linh-Nam and Jeannette iron mines are being worked by the Taiwan Development Company, Ltd., and the ore is being shipped to Japan.

Organization of the Survey Group and Assignments

To carry out the survey of this area there was created the A Group out of the Iron and Manganese Team (formerly, No, 3 Mining Team). The group's make-up and assignments were as follows:

Group member	Jiro Oei	Geology and Ore Deposits
Group member	Shigetake Yoshihara	Mining and Development
Group extra	Katsumi Hamamoto	Measurements
Group extra	Kakuichi Igawa	Mining and Measurements
Interpreter	Itsusaburo Nagata	

Survey Area and Names of Ore Deposits

Mo Linh Nam Iron Mine (Registered mine name: Afel)	Being worked
Jeannette Iron Mine (Registered mine name: Jeanette)	Same
Lang-Hi	New Discovery
Dhai Khai (Former mine name: Paulus)	
Yvônne Iron Mine	Being Worked
Cu Van Iron Mine (Registered mine name: Lilith)	Idle Mine
Phuc Linh	
Nui Trang Hoc	

These are the iron-ore deposits of the French Indo-China Government Reserve Area, Thai Nguyen Province, Tonkin State, that were surveyed this time.

Section 2. Discussion of Ore Deposits

(1) The Lang Hi Iron Mine

1. Summary

The Lang Hi iron mine borders on the Mo Linh Nam iron mine being worked now by the Indo-China Industrial Company. It is a newly discovered iron ore deposit within the Government Reserve Area and is of an unusually large size for this region. It is a metasomatose form of part of the Devonian period sandstone and shale seams and is mostly made up of hematite and limonite, with quite a lot of manganese included.

Its grade is more than 50% FE, and 3 to 4% manganese oxide; the ore deposit is divided into four areas: A, B, C and D. The A and B areas have verified outcroppings, with two large outcroppings in A area each estimated to contain about 10,000 tons of ore. The amount of ore, with a safety factor of 50%, is 17,590,000 tons.

This mine is no more than 2 km from the Mo Linh Nam iron mine presently being worked. From this mine to the Nui Hot wharf and the new wharf at Song Cau, which are being used or under construction, the distance is 2 to 2.5 km. In this interval there are just small rises in an otherwise flat plain. The removal of the ore via the canal would be under the same conditions as those prevailing at the Mo Linh Nam iron mine. Such already established facilities are very convenient. And, with the facilities for hauling out the ore already in, it would be possible to extract a large amount of ore from the first year of operations.

The plan for obtaining 1,000,000 tons of ore annually, with the Mo Linh Nam iron mine as the core source, is being managed by the Indo-China Industrial Company. But, in view of the amount of ore at the Mo Linh Nam and Jeannette iron mines and the limited capacity of the canal there are obvious difficulties. With the discovery of this nearby mine the total of 1,000,000 tons of ore production could be achieved without any worry, if this mine were included. Since the mine is now in the French Indo-China Government Reserve Area, steps to obtain the early approval for opening this up are called for; and at the same time we recognize the need for undertaking developmental preparations.

2. Location and Communications

The Lang Hi mine is in the French Indo-China Government Reserve Area in Thai Nguyen Province of Tonkin State and neighbors upon the Mo Linh Nam iron mine being worked by the Indo-China Industrial Company, Ltd., being about 2 km to the east. It is 75 km from Hanoi north to Thai Nguyen city, provincial seat of Thai Nguyen Province, which is reached by Route Coloniale No. 3 (No.3 National Highway), a 16-meter-wide fully surfaced highway. By auto the distance can be covered in about 1.5 hours. And, there is a 3-meter-wide road (unsurfaced) from Thai Nguyen city to the Mo Linh Nam iron mine six km away; it is passable by auto. From here on, part of the road can be travelled by auto, but there is no road passable to anything but ox carts for the rest of the way.

This iron mine is about 1.5 km from the newest terminus of the rail line running from the already opened and operating Mo Linh Nam iron mine to the Nui Hot storage depot.

3. Name of Concession, Registry Number, Holder of Mining Rights

This mine is in the French Indo-China Government Reserve Area, an area not yet approved for mining. And, since it was first discovered by this survey, there still is no mine name, registry number of holder of mining rights. Thus, we have temporarily taken the name of the nearby area and called it the Lang Hi iron mine.

4. Terrain

The triangular plain of the Red River extending from Hanoi toward Thai Nguyen gives way to an area of low hills, and north of Thai Nguyen there are several ranges of hills 100 to 200 meters high extending north-west to south-east. Finally, beyond them is a mountainous area of around 500 meters. The highest point at the Lang Hi mine is 230 meters (shown as 242 meters on the Pho-Binh-Gia sector map - scale 100,000:1). This mine and the Mo Linh Nam mine are on the first range of these hills, which are marked by the dense forests covering them, the so-called jungle. Near the summits the bamboo forests are particularly dense, making it difficult to walk and providing shelter even now for tigers.

To the south-west of this area flows the Song Cau (Cau River), penetrating these mountains - a meandering river 100 meters wide at Thai Nguyen and navigable by steamers. A tributary of this river, the Mo Linh Nam River, flows eastward to within 1.5 km south of this mine.

The highest point of the Lang Hi iron mine is 230 meters above the paddies at the foot of the mountain; here there is a ridge extending about 500 meters on an east-west line. At the eastern end it connects with a 140-meter high ridge; and then across the valley is the Mo Linh Nam iron mine.

The front (south side) of the 230-meter hill forms a small saddle, beyond which is a ridget of 170 meters formed by three outcroppings and extending to the foot of the mountain on the south. A spur extension of this runs off to the south-west, dropping down to about 40 meters and then forming a 70-meter hill - the D area of the ore deposit.

Abutting the D area on the east and rising to more than 100 meters is a lone peak of limestone rock. Again, on the west of this there is a small group of hills with the external appearance of monadnocks.

5. Geology

The rock forming the region around the Lang Hi iron mine is mainly wind-worn, coarse and medium-grain yellow-white sandstone and red-brown clayey shale. In the A and B areas - the main regions - the strike is east and west and the gradient 30° to 50° to the south. In the north-east valley of the small hill (D area) that has iron-ore boulders the strike is N 80°W and the gradient is to the north-east 60°.

In the south-west part of this region there are five small limestone hills. The highest is over 100 meters high, while the three on the west are lone hills of 40 to 50 meters, looking like monadnocks. The limestone is crystalline and marbleized, often with a few coarse granules so that when observed with the naked eye it does not appear fossilized.

The highest limestone hill, more than 100 meters high, has a stalactite cavern on its west side. According to the "Cao Bang" geological sector map (500,000:1) published by the French Indo-China Geological Office, the period when the sandstone and shale strata of this region were deposited was the Devonian of the Palaeozoic era.

These sandstone and shale strata are covered by dense forests and jungle since this region is undeveloped. The rock outcroppings are very poor, showing the effects of heavy weathering by the tropical climate. And, as much of it has been reduced to clay, its structure cannot be established. The iron ore deposits are formed partly by selective metasomatosis with these piled-up strata and are presumed to belong to the same system as the neighboring Mo Linh Nam and Jeannette mines. In the contiguous limestone strata the kinds of adjoining ore so far discovered of course have not been iron pyrite ore; and this limestone has no connection with the formation of the iron-ore deposits.

6. Summary of the Ore Deposits

These ore deposits enroach upon part of the Devonian-period sandstone and shale strata forming this region and are presumed to be metasomatose ore deposits. There are five known ore outcroppings. (Adding in the large new outcropping discovered later, the outcroppings number six.) These five outcroppings are separated into the A, B, C_1, C_2, and D deposits.

<u>The A Deposit</u>

The A ore deposit is near to the summit of a 170-meter hill and is represented by five large outcroppings. One of these is near to the top of the hill. The upper surface is 50 meters long by 10 meters high. With a thickness of about 4 meters, the amount of the reserve is about 10,000 tons. The surface of the strata, recognized as an originally sedimentary rock, runs east and west. It is formed of hematite and limonite and ~~sometimes~~ contains manganese. Sometimes the manganese is quite abundant and can be taken as manganese ore of fine quality.

The second large outcropping is some 50 to 60 meters north-east of the first one. From here it reaches up to an altitude of about 160 meters. In the central part of this outcropping is a cave large enough to hold a number of men. The face of the outcropping is 25 meters and its height is 20 meters. (The cave is 10 meters above the ground and has a depth of 10 meters.) With a thickness of 5 meters, the overall amount is about 10,000 tons.

The new, large outcropping was discovered by the Indo-China Mining Company as a result of clearing this area. It is near the peak of the 170-meter hill and its size is [text blank] about [text blank] tons. The three large outcroppings became visible as a result of the clearing, and are all continuous - one great outcropping near the top of this ore formation.

Iron ore boulders believed to have broken off from these outcroppings are found on the eastern flank of the mountain at 140 meters, 125 meters and 110 meters, where the boulders are particularly large - many with a diameter reaching 2 to 3 meters. And, those near 125 meters elevation reach a diameter of more than 4 meters.

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The iron ore, chiefly hematite, has an iron content of around 55%, accompanied by about 3% manganese. On the west part of the first large outcropping are many large boulders, which are recognized as part of the outcropping. We believe that from these large outcroppings to the sites of the large accumulations of boulders the whole stretch of iron ore will be recognized as an extension of the one strike.

The B Deposit

The B deposit runs on an east-west line for 230 meters along a hill crest north from the 170-meter hill. It soon plunges down into the bamboo thickets where the boulders cannot be seen, passes through a small saddle and again appears at about 180 meters elevation, where for the first time loose iron ore boulders are seen. In this interval is chiefly red earth, but close examination reveals some bits of iron ore fragments and sandstone.

Now, turning to the west, one sees the third outcropping. This is about 2 meters high and follows the crest line, being exposed for more than 10 meters. Estimated from the strata face, the strike is N60°W, and the gradient to the southwest by 35°.

The fourth outcropping runs east and west near to the center of the crest line and appears in a bamboo thicket as an outcropping about 3 meters square.

Outcropping No. 5 goes from the very highest point toward the south, down along a spur to about 180 meters elevation, having a length of 8 meters, a thickness of 1 meter, a N50°E strike and a gradient 45° to the south-east.

With these outcroppings as the core, the ore boulders are distributed in great abundance on the east-to-west crest line and on the south slope. The boulders occasionally reach 3 to 4 meters in size, but in general they are 1.5 meters in diameter.

The C Deposit

The C ore deposit runs down to the south of the A deposit at the foot of the mountain. Mostly it is ore fragments, the proportion with a diameter of 2 to 3 centimeters amounting to over 80%. On the eastern end of the C area it has an area of about 20 square meters, most of it hematite. And, there the larger boulders 2 to 3 meters in diameter. In this vicinity there does not seem to be a single ore body. On the east side there are many sandstone rocks, while across the valley the hills have only boulders.

This deposit may be connected with the A area in the dense bamboo forest on the south slope of the spur, but ~~at~~ about 70 to 80 meters up the south-east slope the iron ore disappears and only sandstone rocks remain. Again, across more than 20 meters of a rock-free belt one runs into the A deposit.

The D Deposit

The D deposit is between the C area and a limestone hill, on a spur running to the southwest from the A area. Most of the ore rock is on the southwest slope, while they are also very numerous on the west slope. These are mostly 2 to 3 meters in diameter. On the east slope, however, there are very few ore rocks of even 1 meter in diameter, most of them being about 10 centimeters.

On the north side from the summit the ore rocks are very irregularly scattered and are mixed with sandstone rocks. Whereas the color of the soil here is yellow, the C area is separated from this area by a sloping strike of sandstone running N80°W, on a gradient 60°N.

7. The Ore Rock and Its Grades

The ore rock is mostly hematite and limonite, and there is a considerable admixture of manganese. In the hematite there is some shell-shaped and grape-shaped specular iron; and there are very rare crystals of goethite. These are seen in the cave of the second large outcropping.

The manganese is in the form of pyrolusite; and in one part of the first large outcropping a very good quality of manganese ore is found to be included. The grades are as shown in the assay table following. The average is 54% iron and 3% manganese. Mr. Shimizu of the Taiwan Development did the assay on part of the first large outcropping, obtaining again a grade of Fe 54% and Mn 3%.

(Assay by Taiwan Government General Industrial Laboratory, 1942)

Assay No.	Sample No.	Silicate	Iron	Manganese	Sulfur	Phosphorus	Notes
58	A31	2.50%	51.88%	4.69%	0.21%	0.10%	A area ore fragments
59	A32	1.43	57.32	0.07	0.12	1.18	A area loose ore containing water
60	A33	2.90	57.65	0.73	0.13	0.16	A area No.1 big outcropping
61	A34	1.80	57.21	0.30	0.11	1.07	140 mtrs loose ore in A area
62	A37	3.43	54.54	4.05	0.19	0.02	B area No.3 outcropping
63	A39	1.44	56.25	4.73	0.15	0.13	Mn-rich ore of No. 1 outcropping of B area
64	A46	1.78	57.11	0.12	0.17	1.08	No.2 outcropping, A area
65	A56	33.25	26,08	2.39	0.14	0.24	Crustal fimonite from bottom of above area
66	A65	7.83	51.15	4.35	0.13	0.03	60 meters loose ore, D area
67	A66	12.03	48.34	3.53	0.09	0.03	70 meters loose ore, NE slope, A area
68	A68	10.42	46.19	9.88	0.22	0.19	Bottom of above area
69	L-1	5.13	54.46	1.03	0.09	0.36	No.6 outcropping, B area
70	L-2	1.28	48.13	11.23	0.09	0.09	New large outcropping, A area
71	L-3	2.41	54.38	4.53	0.09	0.03	West of summit in B area
72	L-3	3.24	56.56	1.21	0.04	0.13	West part of south slope of B area
Averages		3.63	54.23	3.21	0.12	0.34	Excluding #65 & 68
A area averages		3.14	54.23	3.17	0.13	0.48	
B area averages		3.55	54.99	2.70	0.10	0.13	
D area averages		7.83	51.15	4.35	0.13	0.03	

(Taiwan Government General Industri...

8. Amount of Ore

In computing the amount of ore in this deposit, we note that the major part is in the outcroppings and the ore bodies continuing from them. This survey was held to checking the areas where the dense forest and jungle are being cleared and the ridge lines; and we did not break the surface of the ground, so that we did not engage in stripping and other forms of prospecting digging. Just observing the conditions from the surface of the ground makes it difficult to clarify the form of this ore deposit. But, we can compare the data on the Mo Linh Nam and other nearby iron ore deposits and make estimates. As we presumed from the evidence of the form and quality of the outcroppings that this deposit belongs to the same metasomatose ore beds as the Mo Linh Nam iron mine, we feel that the form of the ore body is quite irregular and goes quite deep underground, perhaps 100 meters straight down, with a safety factor of 50%.

Incidentally, the team members heard a report after they had returned home that a mine shaft was drilled into the central flank of this ore body by the Indo-China Mining Company, thereby reaching into the ore body.

The Ore-Body Part

A Deposit - The area of the outcropping at the summit of the hill is 200 meters from east to west and 150 meters from north to south, so that the area of the A deposit is 200 x 150 x 100 = 3,000,000m^3. Estimating the amount of ore, the specific gravity of the ore rock is 4; 4 times 3,000,000 = 12,000,000 tons. Converting by the safety factor - 6,000,000 tons.

B Deposit - The area of the outcropping on the 230-meter hill is 500 meters east and west and 100 meters north and south; the area of the ore body is 500 x 100 x 100 = 5,000,000m^3. Estimating the amount of the ore, again, the ore has a specific gravity of 4 - times 5,000,000 = 20,000,000 tons; converted by the safety factor to 10,000,000 tons.

Total estimated amount of ore - 16,000,000 tons.

The Ore-boulder Part

The Ore-Boulder Part

The thickness of the ore seams cannot be established without actually doing some prospecting or drilling. But, estimating from the general nature of the ore deposit, it could be 2 meters, with a specific gravity of 2 and a safety factor of 50%.

A Deposit - Top to bottom, 500 meters; Lower edge, 700 meters; and height, 400 meters: the area $\frac{(500 \times 700)}{2} \times 400 \times 2 = 480{,}000m^3$; thus the amount of ore is 960,000 tons.

B Deposit - A triangle with a base of 500 meters and height 300 meters; volume of the ore body $500 \times 300 \times \frac{1}{2} \times 2 = 150{,}000m^3$; and the amount of ore, then, is 300,000 tons.

C Deposit - A rectangle 900 meters east to west, 400 meters north to south; volume of the ore body $900 \times 400 \times 2 = 720{,}000m^3$; therefore, the amount of ore is 1,440,000 tons.

D Deposit - A rectangle 400 meters east to west and 300 meters north to south; volume of ore body $400 \times 300 \times 2 = 240{,}000m^3$; so that the amount of ore is 480,000 tons.

Total amount of ore boulders - 3,180,000 tons. Applying the safety factor against this: Safe amount of ore - 1,590,000 tons.

The overall estimated amount of ore was 35,180,000 tons

Safe amount of ore: 17,590,000 tons

Concerning the computation of this amount of ore:

In the B deposit, the 5 outcroppings were included in the ore-boulder part because they are separated from the site of the crest line and have a somewhat different strike and are not known to include an ore vein. Part of the area of distribution of the large boulders in the C deposit on the eastern edge and part of the west side of the D deposit are estimated to have an underground ore body, but this cannot be firmly stated for the purpose of these computations.

9. Plans for Prospecting in the Lang Hi Iron Mine (First Prospecting Plan)

Lang Hi and the surrounding Iron Ore Reserve Area is divided into the five major areas A, B, C_1, C_2 and D (See figure).

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(1) A area should be called the main body of the Lang Hi mine; it contains two large outcroppings.

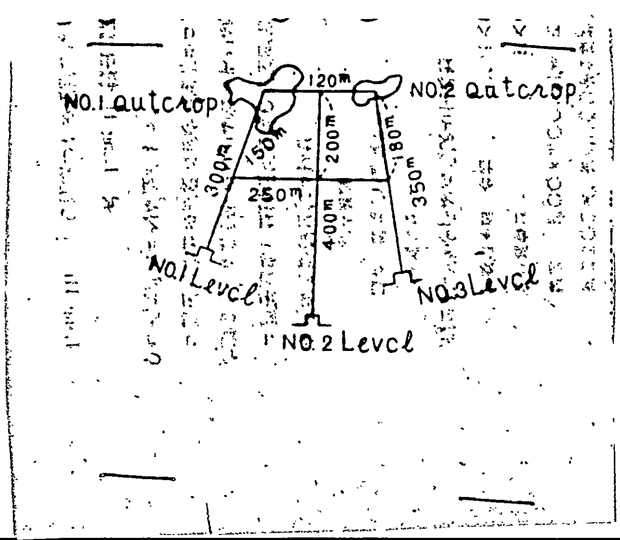
(2) B area is to the north-west of A area and includes outcroppings and loose rocks; it follows along a ridge for about 500 meters. This part of the deposit is probably larger in amount of ore than is the A area. From its terrain and other relationships it is included in the No. 2 plan for development. The appearance of the sandstone strata between A and B areas, as well as east of both of these areas, is as shown by the green lines in the figure. [Which figure is referred to is not indicated.]

(3) C_1 and C_2 areas - C_1 area has loose rock like A area; C_2 area has some isolated small ore boulders.

(4) D area parallels the line of the A, B and C areas and constitutes a small area of ore boulders to the south-west.

Under the primary plan (No. 1 plan) for the development of the mining of the iron ore in this area, the A, B, C and D areas would be the target. Under the secondary plan B area would be mined. Of course, at the same time test mines would be dug for measuring the amount of ore in the whole body. Plans must be drawn up on how the mine transportation shall be in the future and on other arrangements, but herein we are primarily laying out plans for the prospecting of A area.

Now, to effectuate plans for the prospecting [test mining] of each area the trees and jungle growth must be cleared as much as possible and burned off, after which it would be easy to carry out the work.



(1) A Area Prospecting Plan (Primary Mining Plan)

(a) Prospecting Shaft The elevation of the lower part of D area is 0 meters; the lowest part of A area is 100 meters and the highest, 170 meters. Its area is 500 x 200 = 100,000m^2, or 10 hectares. In this space six prospecting shafts (initially three) should be drilled along the two large outcroppings from the summit down the south slope of the hill. The location of the shafts would be as shown in the figure [previous page], each of the three following the ridge line. The No. 1 shaft would be in the lower part of the No. 1 outcropping (The No. 2 outcropping is about 10 meters higher than this.], going down 20 meters. The No. 2 shaft would be in between the 1st and 2nd outcroppings. The No. 3 shaft would follow along the 2nd outcropping. The policy would be to keep the shafts as small in size as possible. Initially, 4 x 5 feet, or 5 x 9 feet (The latter is preferable.) would suffice, with their locations as shown in the figure.

The No. 1 shaft would be 150 meters long; No. 2 shaft, 200 meters; and No. 3 shaft, 180 meters. At their terminals a connecting shaft with a length of 120 meters should be constructed both for mining and for ventilation. And, extensions of these shafts should be srilled 30 meters lower down - 50 meters farther down in the case of the No. 1 outcropping - these running respectively 300 meters, 400 meters and 500 meters in the same direction. A cross-cut shaft of 250 meters should be run across as a connecting shaft for each of these. Placing the shaft entrance in each case according to the contour lines would enable the future mining of each part along terrace lines. Thus, the lowest line in the primary operational plan should be the 50-meter line.

(b) The crest-line clearing line This is the line 5 meters wide and about 1.5 km long that would be cleared from the center of C area to the north part of A area and following the crest line of B area.

(c) Digging the Prospecting Ditches

From the south-west part of A area to the northeast, traversing A area there must be dug three or four ditches 2 meters deep by 2 meters wide running along the slope of the hill. The length of No. 1 ditch

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would be about 300 meters; No. 2 ditch, 400 meters; and No. 3 ditch, 500 meters, each separated from the other by 150 meters. And, running from south-east to north-west in a vertical section of A area would be three or four ditches of the same dimensions as the previous ones, each 600 to 700 meters long and separated from each other by 100 meters. These would reveal the condition of the ore rock and any changes.

(d) Digging the Circumferential Prospecting Terraces

Down 20 to 50 meters from the bottom of the North outcropping and running around the A area there must be cut out a terrace 5 meters wide and as high as appropriate for the amount of earth to be excavated, the gradient being fixed (45° - 50°). On the one hand, this would be to aid the planning of the mining; and on the other hand, it would give information on the amount of earth to be excavated and on the content of stone and ore boulders to be found in the terrace, as well as on the condition of the ore rock. The 50-meter site would be the final terrace in the mining plan. Thereby, the main part of the prospecting plans in A area would be completed.

In general the excavated earth would be dumped in the rear of the area, i. e., in the open valley of smadstone to the north-east. It does not seem that the moving out of the excavated earth will cause much trouble in future mining operations.

(2) Outline of Funds and Time Required for the Primary Prospecting and the Cost of Initiating Operations

For drilling the shafts, rock drills should be used as much as possible. The preparatory period would be six months, and the drilling period one year - a total of $1\frac{1}{2}$ years. 8 to 10 months would probably suffice for digging the ditches.

Machinery to be used and its Cost:

Horizontal 100 h.p. air compressor - 1 set (motor, air tank, pump, related equipment)	¥50,000.00
Conveyance installation	¥20,000.00
Power-supply facilities	¥25,000.00
Compressor shed, motor shed, other related construction	¥20,000.00
Steel tank, and installation costs	¥10,000.00

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R-39 model rock drills: 15 dry type, at ¥400.00 each	¥6,000.00
Rubber hose for the same (3/4" x 50'), with metal end fittings: 60 lines, ¥50.00 each	¥3,000.00
Steel bits for the same (7/8" hexagonal): 400 at ¥15.00 each	¥6,000.00
Other related rock drill equipment, and reserve supplies	¥10,000.00
TOTAL	¥ 150,000.00

Whether steam or electricity would be used for power has not yet been decided.

If a gas generator is used, burning Hongay anthracite, for driving a generator of 200KW capacity, the installation and machinery together would cost ¥300,000 to ¥350,000. Thus, the total cost of getting operations under way would be about ¥500,000 (assuming the use of Phan-me coal and boilers and a steam turbine for electrical power generation).

(3) Crews Required for Primary Mining (including Prospecting)

Japanese technicians	2
Assistants (including machinery operators)	5
Mine foremen (Japanese and Annamese)	3
Coolies	500-600 (including miners)

Prospecting Plan for B Area (Primary Prospecting Plan)

While the shaft drilling and other activities were going on in A area, a terrace should be dug around B area about down from the crest line. The terrace would be about 1.5 km in circumference, with a width of 2 meters. Next, 2 or 3 ditches should be excavated in the south part of B area running north and south and east and west from the valley. The dimensions would correspond with those in A area, and their length would be 500 meters. These would be dug concurrently with the prospecting activities in A area.

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Prospecting in C and D Areas (Primary Prospecting Plan)

Just as with the B area, a circumferential ditch would be dug around C and D areas, as well as 2 or 3 ditches running from south-east to north-west, with a width and depth as in the B area. The period for prospecting in the B, C and D areas would come under the A area prospecting operations. Insofar as necessary, these plans also would subsume stripping of the surface.

10. Prospecting Plan for the Kang Hi [Lang Hi?] Iron Mine

The prospecting plan for the A area is divided into the primary and the secondary plans. The primary plan is covered in the previously discussed prospecting plans. Under the secondary plan, the mining would take place above 100 meters (calling the altitude of the fields below D area 0). In the third plan, the area below that and down to the level of the paddy fields would be mined.

(1) Secondary Prospecting Plan

(a) Minesite and Mining Method

The vertical height of 50 meters from the bottom of the No. 1 outcropping to the terrace at the prospecting shaft entrance (100 meters altitude) would be divided into five terraces of 10 meters each, from No. 6 terrace at 100 meters to No. 1 terrace at 150 meters.

From the No. 6 terrace the ore would go straight down an ore chute to the coal carts (8 carts) on the tracks installed on the L-M line at 80 meters elevation. The carts would be loaded directly through through the mouths of 12 funnels set up above them. Then, they would be lowered by incline or windlass cable to the lower tracks along the canal bank.

The methof of prospecting would be terrace-digging by the long-wall method. Prospecting would begin by digging the first terrace at the top and gradually extending the terraces down the hill side.

Between each terrace pockets (for the ore chutes) would be made for sending the ore to the lower area step by step. The ore carts used on each terrace and the earth-moving carts would have to be wooden, side-opening trucks capable of carrying one tonsof ore or 0.7 tons of earth. The rails set up on each terrace would be 6-ton capacity, 60cm gauge. The excavated earth would be dumped on areas lacking any ore, or on the slope to the valley on the east side of the ore area.

From the No. 6 terrace the ore would be dropped through the chutes and funnels set up at four or five places over the L-M tracks, and then lowered right in the carts by windlass rope R, or by incline, to the lower tracks and sent as is to the canal bank.

Windlass rope	Diameter	15mm
	Length	400-500 meters (800-1000 meters doubled)
Rail capacity		6 tons
Altitude of L-M line		80 meters

Considering the relationship between the height, the length and the machines' capacity, a self-powered steel cableway or a windlass rope using a 10-15 h.p. motor would be needed.

The prospecting plan in C and D areas would involve stripping off about 2 meters of soil containing loose ore rock. This earth would be run down an incline sieve (Large stones could be separated out by hand.) and then on to the ore carts on the south side of the C and D areas. Where the ore bofy is exposed, it would be dug by open-cut mining.

(b) Amount of Ore Production

When the prospecting (Primary digging) of a large amount was completed, the preparations for the mining (secondary digging) would be ready; but, however rapidly this is done, 6 to 10 months would be required. The amount of ore produced, after preparations are made, would depend on the secondary mining plan.

Ore Production of A Area

	Per Day	Per Month	Per Year
No. 1 Terrace	150 tons	4,500 tons	54,000 tons
No. 2 Terrace	100	3,000	36,000
No. 3 Terrace	120	3,600	43,200
No. 4 Terrace	100	3,000	36,000
No. 5 Terrace	100 tons	3,000	36,000

No. 6 Terrace	100	3,000	36,000
Totals	670	20,100	241,200
C Area Production	90	2,700	32,400
D Area Production	75	2,250	27,000
GRAND TOTALS	835 tons	25,050 tons	300,600 tons

In one year 300,000 tons of iron ore could be mined. By progressively carrying out mining plans, the amount of ore produced could be made to increase; and after completing preparations, the amount of ore extracted in a four-year period is anticipated to be as follows:

	A Area	B Area	C Area	D Area	Total
First Year	241,200 tons	-	32,400	27,000	300,600 tons
Second Year	350,000	-	50,000	50,000	450,000
Third Year	350,000	100,000	50,000	50,000	550,000
Fourth Year	350,000	250,000	50,000	50,000	700,000
TOTALS	1,291,200	350,000	182,400	177,000	2,000,600

So, after the fourth yeat it is expected that the four areas together could produce 700,000 tons of ore.

(c) Cost of Opening Up the Mine

Name of Material	Quantity	Unit Price	Total Cost
Incline, or windlass rope	4 sites	¥10,000	¥40,000
Ore carts	400	250	100,000
Ore storage bins	8 sites	10,000	80,000
Tracks (6-ton)	15 km	4,000	60,000
Cross ties, etc. (incl. installing)	-	-	10,000
Chute for each terrace	20 sites	1,000	20,000
Misc. tools (incl. stock of rock drills)	-	-	40,000
Misc. construction materials (for offices, warehouses, company housing, explosives sheds, dispensary, coolie huts, market place, etc.)	-	-	50,000
		TOTAL	¥400,000

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11. Transporting the Ore

Separating the forms of transportation for the mined ore, there would be the small vehicles at the mine and the vehicles for hauling the ore from the mine to the port of Haiphong. The small vehicles at the mine have already been dealt with in the section on prospecting.

For transportation from the mine to the portoof Haiphong there are two methods. First would be to use the equipment just about as in the past, running tracks from the mine to the canal bank (As is done now at the Mo Linh Nam mine, where a steam engine is used - here extending the 6-ton triple-track rails 2.5 to 3 km, using one track for empty cars.). At the canal bank 100-ton or 200-ton lighters are loaded, hauling the ore down to Phu Lang Thuong; and then barges and small steamboats are used on the lower waters of the Song Cau, passing through Song Thuong and going on to the port at Haiphong. From the first dam of the canal to the end of the canal the total length is 53 km. 7 km before the end is Phu Lang Thuong. The canal's starting point is a site 12 km downstream on the Song Cau, which passes near to Thai Nguyen city.

Minesite to canal bank (or the Nui Hot depot)		3 km
Total length of the canal		53
From end of canal to the port of Haiphong		114
	TOTAL	170 km

The canal uses the lock system, being equipped with double locks in eight places. Opening and closing them is accomplished by human labor. The lighters are pulled like barges by human labor from the canal bank.

Width of canal surface	18.4 meters
Width of canal bottom	10-12 meters
Depth of water	2-3 meters (1.7 meters below draft of the lighters)
Distance between lock gates	40-50 meters (permitting 3 or 4 100-T lighters at a time)
Width of canal locks	6 meters
Canal rate of flow	$780 m^3$/minute

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Size of lighters	100-200 tons
Passage time for lighters in locks	40 seconds
Time when canal may be used	6-11AM, 1-5PM

Under the most ideal conditions the transporting capacity of the canal would not surpass 500,000 tons a year. The usual top capacity should be set at 300,000 tons. Therefore, when the amount of production goes above 300,000 tons, including that from the other mines - Mo Linh Nam, Jeannette and Yvonne - the canal itself definitely would not suffice, and a second means of transport would have to be devised. One method would be to build a rail line from the mine to Phu Lang Thuong. The track either would be located direct from Lang Hi to Phu Lang Thuong, or would use the presant canal levee. Under either system:

1. The canal and tracks both should be used.
2. The difference in elevation between the mine and the canal would be 15 meters, while that between the two ends of the canal would be no more than about 10 meters, so that it is almost level.
3. At the very minimum the rails should be 15-ton capacity.
4. For ties, fairly large ones would be best: 15 X 20 cm and about 120 cm long; and they should be laid close together - 50 cm as against the usual 60-70 cm. The rail gauge would be 65 cm.
5. Under the ties, plenty of ballast should be laid (fine limestone gravel.)
6. The steam locomotives should number 6 (one for reserve).
7. The ore cars should have 10-ton capacity (wooden, side-opening), pulled 10 cars to a train.
8. The hauling capacity per locomotive per day would be 200 tons.
9. There would be ten derail points along the way from the mine to Phu Lang Thuong. With a hauling time of 10 hours in one day and a round trip requiring 4 to $4\frac{1}{2}$ hours, one locomotive would make two round trips a day.

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For the trip from Phu Lang Thuong to Haiphong, barges and small steamboats would be used.

Amount of ore transported in one day	900 - 1,000 tons
One lighter's load of ore	100 - 200 tons
Time required for Phu Lang Thuong-Haiphong round trip	3 days

There would be three barge steamers, each pulling six to eight lighters at a time - about 1,000 tons of cargo.

Considering the new freight and transportation arrangements over and above the present system, a six-ton triple-tracked light railway from the mine to the new ore storage depot at Mo Linh Nam would enable the canal to be used to its maximum capacity.

If the ore extracted from the iron mines below Lang Hi and Mo Linh Nam is of fine quality, it would not be too late by any means for taking up a second means when it became impossible for the canal alone to handle the flow of ore.

12. Construction Expenses

(1) Railroad construction

Name of Item	Quantity	Unit Cost	Cost
Earthworks	60 km		¥300,000
Rail (incl. cost of 15-T construction)	60 km		300,000
Steam locomotives	6	¥20,000	120,000
Ore cars	50	2,000	100,000
Station, Water-supply facilities			5,000
Canal-side storage depot			20,000
Mooring place for lighters			15,000
Electrical communications (including telephones)			30,000
		Total	¥890,000

(2) Ore-hauling vessels

Lighters - 300-ton capacity	6	10,000	¥60,000
Small steam vessels	3	30,000	90,000
Wharf at Haiphong port and another ore-loading facility			60,000
		Total	¥210,000
		GRAND TOTAL	¥1,100,000

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Primary digging equipment (including power facilities)	500,000
Secondary " " " " "	400,000
Ore-hauling railway facilities	1,100,000
Total	2,000,000

13. Projection of F.O.B. Haiphong Base Price per Ton of Ore

(1) Mining costs	$1.60
Mining cost	0.35
Earth Removal	0.20
Small transport at minesite	0.10
Materials	0.30
Explosives	0.25
Supervision	0.20
Miscellaneous	0.20
(2) Transportation costs	$2.55
Transportation to Haiphong (lighter)	1.80
Rail and lighter repair	0.20
Ore-car loading and unloading	0.15
Lighter loading	0.10
Loading at Haiphong	0.20
Misc. export costs	0.10
(3)	
Misc. costs of storage at Haiphong	0.10
Depot Ship loading	0.70
Various export costs and taxes	0.45
Mine tax and rental	0.45
Capital profits	0.15
Capital amortization	1.00
Management costs	0.50
Total	3.35
Therefore, per ton of ore	7.50
plus 4% loss intransit to Japan	.30
	7.80

14. Accounting of Property

The amount of property required for the development of the miningof the Lang Hi iron mine and for hauling out the ore is briefly as follows (It is chiefly steel, pig iron and brass). However, these computations show very much abbreviated figures, and the details must be corrected when this report is rendered.

	Steel	Pig Iron	Zinc, Brass	(in tons)
100 h.p. air compressor	300	800	100	
Motor for the above	300	400	180	
Air-compressor tank	100	-	-	
Related pumps, etc.	100	100	50	
Steel pipe (1,800 meters of 12-cm, 500 meters of 5-6cm)	15,000	-	-	
Fifteen R-39 rock drills and related metal tools	1,500	2,000	500	
400 7/8" bits	1,500	-	-	(Special steel alloy)
200KW dynamo	600	800	200	
Engine for the above	1,800	1,000	50	(Using gas engine or boiler)
Transformers, switchboards, other equipment for distributing electrical power	100	300	700	
400 Ore carts	60,000	85,000	200	
Incline (Rope - 20 cm[sic] in diameter, 1 km long - for four locations, incl.reserves)	6,000	-	-	(Special steel)
Same: buckets and hangers,etc.	160	-	-	
Cableway (15-cm rope 1 km long, four locations, plus reserves)	4,000	-	-	
Same: buckets, hangers, etc.	200	-	-	
16 km of 6-ton rail (plus related materials)	62,000	-	-	
Same - 18 km	101,600	-	-	
Totals	255,260	90,400	1,980	

In addition to the above, 300 tons of steel, 100 tons of pig and 2 tons of brass would be needed for tools. And, if rails are supplied for installation of a 15-ton ore railway on the canal levee, about 1,700 tons of steel would have to be added in, the distance from the mine to Phu Lang Thuong being 55 km.

15. Conclusions

The Lang Hi iron mine is an iron-ore deposit newly discovered by the survey team. It neighbors on the Mo Linh Nam iron mine, which is being worked; and it is about 2 km east of there. The ore is hematite and limonite, with an average grade of 54%; and it is very rich in manganese. The deposit was formed metasomatosely from the strata of sandstone and shale. The inferred amount of ore is 35,180,000, computed by a safety factor of .5 to 17,590,000 tons.

As noted above, this iron mine is of a large size rare in this vicinity and has the advantage of being able to utilize the existing facilities of the nearby Mo Linh Nam iron mine, which is being worked; and it is recognized to have the value of being speedily developable.

As to the development of this ore deposit, it would first of all be necessary to prospect a part. And, if it were planned to accelerate the development by using mechanical power, about 1½ years and ¥150,000 would be required for the primary plan. If power equipment of as much as 200KW thermal generating station were installed, the installation expenses required would mount to ¥500,000. If the secondary basic mining plan should use terrace-method strip mining on six terraces, centering on the A, C and D areas, ore amounting to 300,000 tons in the first year of operations and 700,000 tons from the fourth year onward could be produced.

The necessary materials for the above would be 400 tons [?] of steel and pig iron; and the cost of starting operations at the mine would be 400,000 piasters. The F.O.B. Haiphong per-ton base cost of the ore would be about 8 piasters.

The movement of the ore would depend heavily on the use of various existing facilities and the canal. It is estimated that the maximum capacity would be 500,000 tons per year. But, by the secondary mining plan, including the transporting facilities of the Mo Linh Nam and Jeannette mines, 1,000,000 tons of ore could be moved out by using a railway that would be constructed parallel to the canal. In this case, about 1,000,000 piasters would be required for construction. As for the ore-hauling railway, the convenience of using the canal levee may be considered, but detailed investigations and studies would

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be required on this route.

As above, this iron mine is located very conveniently, and the amount of ore is quite large. Also, the preparations for mining are comparatively simple so that after the first year following the start of operations 300,000 tons of ore could be produced. And, the F.O.B.? Haiphong cost easily enables the mining. The plan for extracting 1,000,000 tons of iron ore chiefly from the Thai Nguyen area is now quite uncertain; but this would easily ensure [the success of] the plan and meet the need for speedily beginning the development.

Now, the survey of this ore deposit was limited to several days of inspecting in the existing jungle, and the data must be said to be insufficient. Hereafter, a full prospecting survey will be necessary. But, the fact that such a promising ore deposit has been discovered in the Thai Nguyen Reserve Area underscored the promising nature of this region. We earnestly hope to see a thorough-going survey of the whole region hereafter.

Especially does the zone connecting the Mo Linh Nam, Lang Hi and Yvonne mines not only hold great promise of holding huge iron ore deposits, but also since no comprehensive survey has been made to date, it is necessary to carry our a survey of the region, to establish the value of the ore content of the Thai Nguyen Reserve Area, and to set up a basic policy for opening and developing the whole region.

(2) The Dhai Khai Iron Ore Deposits

1. Location and Communications

Dhai Khai is located over 8 km north-west of Thai Nguyen city, the provincial capital of Thai Nguyen Province, Tonkin State. It is 75 km north of Hanoi. It can be reached along Route Coloniale No. 3 by car from Hanoi in $1\frac{1}{2}$ hours. The road from Thai Nguyen to Dhai Khai is 3 meters wide and unsurfaced, but autos can pass to a point about 7 km north of here [the minesite?] near Lang Hit.

There are scattered iron-ore rocks in this region. The first
30 site is northof a farm by the roadside 8 km from Thai Nguyen. To

the north of the farm is a limestone hill. The second site is reached by following along the road for another kilometer to a small hillock cutting across the route.

2. Concession and Holder of Mining Rights

Dhai Khai was a concession having already been granted mining rights when the reserve area was set up by the French Indo-China Government in Thai Nguyen in 1913. It was given the concession name of Paulus and was owned by Mr. George Barondeau, but we were told that later on, as a matter of convenience for mining operations, it was abandoned in favor of the Jeannette concession. Thus, it is now part of an area not set up for mining.

3. Terrain and Geology

This area is on the "Cao Bang" sector of the French Indo-China map, 500,000:1 scale, in a region shown as belonging to the Devonian period of the Palaeozoic era. It is composed of the same sandstone and shale strata as the Mo Linh Nam iron-mine region. There are low 40 to 50 meter hills cut through by the Song Cau and its tributaries. It is an aged terrain with gently rounded hills.

In the first site, the outcroppings of strata are poor, with only sandstone pebbles and iron-ore rocks and boulders to be seen scattered in the jungle; but in the vicinity of the second site the sandstone strata crop out with a strike of N20°E and a gradient of 60° to the east.

The area is covered by dense jungle interspersed by bamboo thickets, so that without clearing a way through it is impassable to travel beyond the road.

4. General condition of the Ore Deposit

(1) First site

The first site is in the region formerly called the Paulus concession; and there are many traces of its having been mined, such as ditches and pits in many places. The ore deposits start on a 150 meter hill north behind a peasant farm 8 km from Thai Nguyen. At a point about 500 meters from the road one begins to see iron-ore rocks scattered about; and the rocks and pebbles range over an area about 500 meters from north to south and 400 meters from east to

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west. The ore rocks are scattered around on the ground in the western half of the area, while in the eastern half there is a red-earth hill covered by dense woods and bamboo thickets so that no rocks at all can be seen. The first and second ditch excavations run along the south side of the small hill for many meters. Here, about two meters below the surface of the ground the ore rocks are very densely distributed for a depth of about 2 meters. We estimate the ore content of this part to be over 50%, composed of a mixture of hematite and limonite with, again, an estimated grade of about 50%.

The first ditch is dug out on a strike of NE15° for about 15 meters, while the second is on a line with the first, running north for more than 15 meters. Each is about 2 meters wide and has an average depth of 2 meters, with a maximum depth of over 1,000 meters [sic]. Near to the entrance of each some 10 to 20 tons of ore have been taken out and piled up. The ore rocks are mostle 0.3 meters in diameter, with some over 2 meters in diameter.

The first pit has a 1.7-meter square section and a depth of 3 meters. From the amount of ore thrown out nearby, we computed the percentage of ore content to be about 3%.

The second pit is near the northernmost limit of the area at an elevation of about 50 meters. It has a 2-meter square section and a depth of 2 meters. From the same evidence as with the first, we computed the ore content at 10%. It is an iron ore contaoning considerable manganese and is a mixture of hematite and limonite. But, when the ore is rich in limonite, limestone rocks are also mixed in.

Besides the above, there are many excavations; but since the prospecting period was long ago the local natives do not know their location; and we could not find them.

(2) Second Site

This site is more than a kilometer north of the first, along the road on a mountain pass. Here at the road cut sandstone strata of a light-yellow-brown color and rather coarse grain is exposed cutting across the road on a strike of N20°E and a gradient of 60° to the southeast. On the north side, many meters away the iron ore crops out.

The ore is composed of hematite and limonite with a grade as shown in the assay table below. With an average iron content of 53%, it is comparatively good ore. In the part cut through by the road, the ore fragments amount to about 10%, with the larger ones measuring .3 meters in diameter in a breccia form.

By expending some effort, we cleared and checked three nearby hills of around 50 meters elevation; but in then we could only find sandstone and no iron ore.

Near to the first site, at the easternmost part of the hill in a small ravine we found iron ore rocks of about 15 cm diameter occurring in conjunction with red sandstone rock.

Assay No.	Specimen No.	% SiO_2	% Fe	% Mn	% S	% P	Notes
25	A 40	4.19	50.13	Trace	0.21	0.17	1st site, 2nd shaft
26	A 41	3.84	54.92	0.09	0.14	0.71	No. 2 and 3 site, block above road
27	A 42	1.81	57,20	1.67	0.18	0.14	1st site, 1st pit
28	A 45	1.43	53.51	6.51	0.17	0.07	No. 2 pit
29	A 49	1.30	34.50	22.26	0.15	0.06	Summit outcropping
Averages		2.82	53.94	2.07	0;17	0.27	Excludes No. 29
Manganese Ore		1.30	34.50	22.26	0.15	0.06	No. 29

(Assay by Taiwan Government Genral Industrial Laboratory, 1942)

5. Amount of Ore

There is no purpose served by computing the amount of ore in the second site. Computing the amount of ore in the first site:

Area of ore distribution   500m x 400m = 200,000m^2

Thickness of ore-bearing zone in trench   2 meters

% content in trench - 50%; in pit - 3-10%: average 20%

Total volume of ore rock: 200,000 x 2 x 0.2 = 80,000m^3

Specific gravity of the ore: 4

∴ estimated amount of ore: 4 x 80,000 = 320,000 tons

Considering 60% of this to be mineable: 192,000 tons

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6. Method of Development and Cost of Initiating Operations

After computing the amountiof ore in this mine as above to get 320,000 tons overall and 192,000 tons mineable, we can estimate 10 years as the tiem required for mining it, or about 19,200 tons a year, 1,600 tons a month, and 60 tons a day.

The mining method would use trench and pit excavation by 60 workers per day for six months continuously during the year.

Wages	5,400 piasters
Tools	2,000
Supervision	3,600
Office expenses	3,000
Miscellaneous	2,000
Total	16,000 piasters

The method of mining would be to gradually work down the hill side, excavating open-cut terraces. Terrace height: 6-10 meters, slope 50 - 60%, width 6 meters. On each terrace would be installed 6 kgr" [sic] rails for hauling the excavated earth and ore in hand-push carts (60cm gauge rail). The ore would be dropped by stages through chutes and hauled to Thai Nguyen in ore carts. There would be four terraces spaced every 10 meters, beginning with No. 4 terrace at 10 meters, No. 3 terrace at 20 meters, etc.

Picks and shovels would be used for the digging, and the hard ore would be broken by explosives and then dug by hand.

Employed miners, other workers	80
Mine foremen	2

Expenses for one month:

Miners' wages	1,600.00 (incl. cost of earth excavation)
Explosives	260.00
Tools	260.00
Supervision	300.00
Hauling and loading at mine	400.00
Miscellaneous expenses	380.00
Total	3,200.00

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Cost per ton of ore	2.00
Shipping from mine to Thai Nguyen (or to Hui Hot) - per ton	1.50
Other loading costs	0.15
∴ costs of mining and storage total	3.65

Cost of initiating operations:

Prospecting	16,000.00	
Excavating the mine	20,000.00	(Wages, supervision & offices)
Railway	25,000.00	(5000/pi./km to mine)
Ore carts	10,000.00	(50 at 200 piasters each)
Storage depot	6,000.00	
Construction	30,000.00	(office,whse,miners' housing, etc.)
Total	107,000.00	piasters

Cost of railway construction - mine to loading point:

Rails	40,000.00
Roadbed and installation	50,000.00
Total	90,000.00

Thus, all prospecting, mine-opening and initial expenses would require 200,000 piasters.

7. Conclusions

The Dhai Khai No. 1 area was within the scope of the explorations this time. The estimated amount of ore is 320,000 tons, with 192,000 tons mineable. The ore is hematite and limonite; its grade is above 50%, averaging 53%. The area is located 8 km from Thai Nguyen city near to the Mo Linh Nam iron mine, which is being worked; and overall operating costs make it worth considering.

To mine it, prospecting costs of 16,ooo piasters and a total initial opening cost of 200,000 piasters would be required - if the mining is from open-cut terraces.

This concession was once held and prospected by a Frenchman, but the prospecting still must be said to be inadquate. So, when mining begins, a full survey should be carried out to supply the data quickly, Judging from present conditions, this concession could be considered after first opening up the whole Thai Nguyen Reserve area, but cannot now be developed without approval from the French.

(3) The Yvonne Iron Mine

1. Location and Communications

The Yvonne mine is in Thai Can village, Dong Chi county, Thai Nguyen Province, Tonkin State - about 16 km east of Thai Nguyen city. The 75 km from Hanoi to Thai Nguyen is serviced by public bus over a completely surfaced road, the Route Coloniale No. 3. By auto the distance can be covered in about $1\frac{1}{2}$ hours.

To reach the Yvonne mine - Route Coloniale No. 3 was extended 5 km east of Thai Nguyen a year ago. Then, it is 5 km by the canal to the first lock. A new road has been constructed from here to the recently opened mine - 9 km to Nui Quang - enabling this minesite and storage area to be reached. The 19 km from the fork in the Thai Nguyen road to the first lock of the canal are not yet surfaced, but the road is comparatively good, being passable by auto at the present time. However, from the canal to the mine the newly built road is not good, being reported impassable by auto in the rainy season.

The mine offices are near the first canal lock, and the technicians would live here.

2. Concession and Holder of Mining Rights

This mine had already been granted rights when in 1913 the French Indo-China Government established the Thai Nguyen Reserve Area, and thus it was excluded from the area. The concession is named Yvonne and belongs to a mining concession. The owner is a Frenchman named Mr. Redon Colombier, an official of the Dong Trieu Coal Mining Company. Though he is living in Paris at present, the execution of the mining plans is in the hands of the Dong Trieu Coal Mining Company. The concession is a rectangle 3.7km x 1.4km in size, having a total area of 5.18 sq. km.

3. History

We do not know when this mine was discovered, but we were told that it was discovered long ago by the Chinese, who manufactured iron nearby - farm tools, cooking utensils and picks. Near to Trai Cau village there is said to be an ore-tailings dump by the roadside. And, we were told that fifty or sixty years ago the king of Annam was a Chinese, and that he had a sloping shaft dug near to the top of Mt. Nui Quang for carrying out prospecting.

In modern times, the French have come into the area to measure the amount of ore, and thus have known of the site as the location of an excellent iron-ore deposit. In 1901 they first set up the Societe Metallurgique et Minier de IndoChine, looking toward the establishment of a concession. Thereafter it was transferred to the ownership of Mr. Colombier's late father.

In 1925 Mr. Redon Colombier excavated three horizontal shafts at the top of Mt. Nui Quang and conducted a prospecting survey.

When the French Indo-China government's reserve area was set up, centering on Thai Nguyen city, the existence of iron ore deposits at various sites was known. At present the known areas are Dhai Khai (Paulus), Mo Linh Nam (Elephant), Jeannette, Mo Na Kong, Yvonne, Mo Na Luong, Cu Van and Ky Phu.

The various prospecting and test mining operations have established that this is one great iron-ore deposit zone. This has attracted some attention; the Yvonne iron mine is especially known for its fine and abundant ore. And, the Phan-me coal mine has been discovered northwest of Thai Nguyen city; its coal is bituminous - of coking quality suitable for manufacturing. Knowing this, the French Indo-China government is planning a great iron and steel manufacturing enterprise in Tonkin State based on these two sources. For a route to haul out these ores and serve the purpose of providing irrigation for the surrounding flatland, they have decided to dig a large canal 55 km long between Thai Nguyen and Phu Lang Thuong. After the work of excavating the canal is completed, it would not be difficult to develop the Phan-me coal mine, and also the Yvonne iron mine, which has only been prospected and then long abandoned.

Recently the Dong Trieu Coal Mining Company has again been pushing the development of this iron mine. At the time of this survey they were doing prospedting by means of a sloping shaft and digging in the area of Nui Quang, as well as constructing a 7 km railway connecting Nui Quang with the canal.

This railroad construction is now starting from the mine, with work being done on the road bed; and according to our discussion with the French crew there it is expected to be completed in two more months. The material being used is from the reserve stocks of the Dong Trieu Coal Mines because of the bad business conditions resulting from the war.

In 1940 about 2,000 tons of iron ore were sold to the Indo-China Industrial Company, and Taiwan Development is holding in storage at Nui Quang some 1,000 tons of ore to be sent to Japan.

Hauling from the mine to the canal will be done by motor lorry, at a rate of 2.5 piasters a ton.

As for publications on this mine by Japanese, there were two reports of surveys in 1926 and 1927 (published under the name of the Ko-A In [Raise Asia Institute] of the Taiwan Development Company, Ltd.

4. Terrain

The triangular plain of the Red River, which formed the Tonkin plain, has on it some low hills to the south of Thai Nguyen, hills no more than 20 to 30 meters high. Here is the Yvonne iron mine on one of the hills.

North of there are ranges of hills about 200 meters high; and further north are mountains of about 1,500 meters. The rivers in the neighborhood of the mine are tributaries of the Song Cau, rising in this northern mountain area. The larger one among them is the Sui Na Kong River, flowing to the southwest in the northwest part of the concession. And, there is the Can Da River which flows into the Sui Na Kong below the village of Can Da at the eastern end of the concession. The zone in which the concession lies is formed by gently rolling hills of 20 to 30 meters elevation, but near the mine these hills are interspersed with marshland. And, except for the portion cleared to make possible the prospecting and test digging, the hills are all covered with dense vegetation, making excursions off the small paths impossible.

5. Geology

Only the major part of this concession was explored, the Nui Quang area, because of the time allowed for the survey. However, within the scope of the exploration, we found no rock outcroppings, just iron-ore rocks lying on the ground; and from data derived from the digging and prospecting we found only red clay, clay-quality sandstone and limestone. Thus, we could learn nothing of the strike and gradient. According to the "Hanoi" sector map, of 500,000:1 scale, published by the French Indo-China Government's Geological Bureau, the strata of this area belong to the Rhatien period of the Mesozoic era. To the north they adjoin strata of the Devonian period of the Palaeozoic era. On the bank of the canal 7 km southwest of the concession there are outcroppings of red sandstone.

According to the old survey reports, this vicinity is formed of red sandstone and shale strata, with a strike of from N60°W to directly east and west, and a steep gradient.

Limestone was found at the bottom of the No. 2 test pit below 31.4 meters; and fine crystals of pyrite had permeated into part of the ore.

6. The Ore Deposits and the Ore Rock

The ore od the Yvonne mine consists of magnetite, hematite and limonite, the magnatite being the most important of these. The others were formed secondarily by the weathering of the ore.

The ore originates in the Rhatien red rock strata, and that seen in Nui Quang is covered by about 2 meters of red earth, with some ore rocks forming a 2 - 3 meter layer parallel to the surface of the ground. As the local Frenchmen explain it, there is a second layer below this, but this was not found from the data gathered at the canal and the test pits. On the surface of the ground there are scattered large boulders of several meters diameter, while outcropping ore was found on top of Mt. Nui Quang and in the vicinity of the so-called No. 8 ore deposit.

The ore boulders have some sharp edges and corners, making it difficult to consider that they were moved here by water action. Rather, they must be secondary remnants of an ore deposit which weathered away at this site. This is identical on the whole with the iron ore deposits

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found in the Thai Nguyen region, formed by metasomatose effects. And, looking at the fact that the main ore rock is magnetite and that limestone rock was brought out of the bottom of the test pits with permeating pyrites, we recognized that part of this had been effected by contact. According to the old survey documents and the explanations of persons connected with the mining area, the ore deposits occur in 14 locations in the concession and are arranged in four groupings separated from each other by 150 to 500 meters, as follows:

Group 1	No. 1 Deposit	Summit of Mt. Nui Quang
	No. 8 Deposit	Small outcropping in flatland on northwest part of Nui Quang
	No. 9 Deposit	Near road on west part of concession
Group 2	No. 12 Deposit	West of Cau Da
	No. 13 Deposit	Same
	No. 14 Deposit	Same
	No. 6 Deposit	North part of Nui Quang
	No. 2 Deposit	Same Near No. 3 pit
	No. 3 Deposit	Outcropping on south bank of Cau Da River
Group 3	No. 7 Deposit	North part of Nui Quang, S. bank of Cau Da R.
	No. 4 Deposit	Hilltop on north bank of Cau Da R.
	No. 5 Deposit	"Shrine Mtn." outcropping on north bank of Cau Da River
Group 4	No. 10 Deposit	Hill to east of Trai Cau
	No. 11 Deposit	Same

The main part in the inner hills to the north is the No. 1 ore deposit on Mt. Nui Quang. Most of the earlier mining was carried out in this region. Even now part of it is being worked.

These ore deposits all are found on the low hills surrounding the marshland and paddies. The highest is the No. 11 Deposit about 60 meters above the surrounding flatland. The No. 1 Deposit is 45 meters above the level of the canal and no more than 15 meters higher than the road. This vicinity os overgrown by dense jungle; and without special clearing it is impossible to travel beyond the small paths now being used.

The results of assays gleaned from this regionaare as follows:

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Assay No.	Specimen No.	% SiO_2	%eFe	% Mn	% S	% P	Notes
30	A 53	0.46	68.44	0.33	0.09	0.02	Nui Quang No. 1 Shaft
31	A 90	2.27	64.89	0.09	0.12	0.03	No. 8 Deposit
32	A 91	0.55	64.56	1.24	0.08	0.07	Nui Quang No. 1 Shaft
33	A 93	0.33	68.40	0.27	0.07	0.02	Same. Outcropping beside No. 5 shaft
34	Unnumbered 1	0.35	68.78	0.03	0.07	0.02	Same. Fine ore from storage depot
35	Unnumbered 2	0.32	69.18	0.15	0.07	0.02	Same. Coarse-grain ore
Averages		0.71	67.37	0.35	0.08	0.03	

(Assay by Taiwan Government General Industrial Laboratory, 1942)

7. Prospecting

Evidences of the prospedting of this mine carried out by the Chinese on orders from the Annamese king many decades ago are said to be visible still on Mt. Nui Quang; but we did not observe any. We were not informed by the local inhabitants of the three small horizontal shafts dug by Mr. Redon Colombier in 1925, but we were told of the Nos. 1, 2, 5 and 6 pits of the nine test pits on Nui Quang. These four pits cannot be entered now and could only be inspected from ground level. The others were buried by the jungle, which is now impassable.

Among those recently dug upon the opening of the enterprise are 3 test pits and 5 trenches. One of the test pits is on the west end of the concession near to the road. The rest are in the Nui Quang area. Trench No. 5 is down below the road, southwest of Mt. Nui Quang. It runs north for 33 meters; where the top soil is 1.3 meters thick, while the thickness of the ore-bearing zone is 2 meters. The lower part of the zone also contains soft yellow sandstone gravel. The ore rocks are about 10 cm in size, with large ones running to 30 cm.

The No. 4 trench is in line with No. 5 trench on the southwest side of Mt. Nui Quang. The red topsoil is 2 meters thick, and below it is a zone of ore rock about 2 meters thick. And, below that is yellow clay.

According to the explanations of the French technicians, a survey conducted above here in 1937 showed that the clay is 8 meters thick and that below it is another 2-meter zone of ore rock. This was not confirmed. This vicinity is the starting point of a rail line, and terrace excavations are said to be projected in three places.

Test pit No. 1 is 1.5 meters square and 27 meters deep. The topsoil is about 2 meters thick; and the zone of ore rock is 2 to 3 meters thick. The ore contains manganese. In the soil taken from the shafts in this vicinity no snadstone fragments were to be seen.

Test pit No. 2 is 1.5 meters square and 31.4 meters deep but the inside has collapsed so that now only 15 meters can be observed. The topsoil is 2 meters thick, and the zone of ore rock is 2 meters thick. The ore is in fairly large pieces, being magnetite with sharp edges. The ore is reported to be about 70% of the overall volume. There is limestone in the bottom which, raised to the surface, was found to have infused cubic crystals of iron pyrite.

Test pit No. 5 is round with a diameter of 2 meters and a depth of 35 meters. From the ground level downwards there is ore gravel. On the ground in the vicinity of the pit there are large ore boulders 2 meters in diameter. The ore rock has changed to a considerable degree into hematite, but in the center crystalline magnetite remains.

Test pit No. 6 is just inside the concession from the road. It is 15 meters deep. In this vicinity there is a 1.5-meter thick zone of ore rock lying 2.5 to 3.0 meters below the ground. The, for 8 to 10 meters one finds weathered, soft sandstone strata. The ore is hematite only, with a grade of about 65%.

8. Amount of Ore

As for the amount of ore in this mine, previous reports fix it at 1,500,000 tons, 6,000,000 tons and 15,000,000 tons. Though the data is not complete, for the Nui Quang area we explored the amount of ore is estimated as follows: Area of the concession: 80 hectares. Thickness of the ore zones: 2 meters. Specific gravity of the ore: 4. % of ore in the ore zone: 30%.

$$800{,}000 \times 2 \times 4 \times 0.3 = 1{,}920{,}000 \text{ tons}$$

Thus, we estimate the amount of ore to be about 2,000,000 tons.

9. Present State of the Mining

As the ore deposit of the Yvonne iron mine lies below the surface of the ground of the hill and the flatland, the mining of the ore exposed above ground would be by open-cut digging; that underground would be worked by shafts. The present outcroppings are open-cut strip mined. The ore

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below the surface on the flatland is being dug from prospecting shafts (cross-cut and sloping shafts).

At present, the ore being produced from the diggings in preparation for installation of the railroad is being graded into ore rock and earth, and the ore rock is being piled up. In the Nui Quang storage depot there are now more than 1,000 tons. For transporting the ore, ox carts and carts are used.

10. Future Policy

As for mining methods, a distinction is made between mining on the surface and mining below the surface. That on the surface would employ the open-cut terrace method, with each terrace roughly 5 meters high and with the mining gradually moving down the hill. On each terrace a light railway would be constructed (6 - 8 ton rails. First, the mining would start with the Nui Quang No. 1 deposit, the most important deposit, and would gradually extend to other above-ground deposits. Mining below ground would begin with sloping and vertical prospecting shafts, or - where these already exist - with the renewal and reconsturction of the shafts so that the amount of ore could be determined and digging could be undertaken in earnest. Though there are ore bodies below ground, it is difficult to expect that they will be large. Most of the mining would be in the ore-rock zones and would use the terrace-mining method of open-cut working. For dumping the excavated earth and rock, the nearby low ground would be suitable. Between the mine and the canal small-scale hauling on the light-duty railroad in hand-pushed ore carts (0.6-ton capacity) would suffice.

11. Costs

The prospecting is not yet adequate with respect to the amount of ore. Firming this up is something that must be awaited, but meanwhile 30,000 tons a year, or about 100 tons per day could be mined, with the costs roughly as follows:

	Costs per ton of Ore
Wages for mining	¥1.00
Explosives	0.50
Tools and equipment	0.30
Light hauling at mine	0.50

Supervision	0.50
Military affairs office	0.20
Sub-Total	¥3.00
Loading and unloading on light light railway	1.00
Freight costs on light RR	2.00
Total	¥6.00

The high cost of mining wages for each ton is chiefly due to the small amount of ore produced. Until the above-detailed mining is started, the main prospecting, opening of the mine and other facilities expenses would be as follows:

Prospecting	¥25,000(in 1 year)
Opening the pit	65,000
Facilities, etc.	40,000
Total	¥150,000

The ore of this mine is of much better quality than that of the nearby Jeannett and Mo Linh Nam iron mines which are being worked. Therefore, as much as possible should be produced to lower the per-ton cost of mining. This would make it necessary to improve the quality of the iron ore already taken out of the ground.

(4) The Cu Van Iron Mine

1. Location and Communications

This mine is in Cu Van village, Thai Nguyen Province, Tonkin State - 14 km northwest of Thai Nguyen city, which is 75 km north of Hanoi, capital of French Indo-China. It is reached from Hanoi by the surfaced Route Coloniale No. 3, which runs on past Thai Nguyen for 10 km. From the fork in the road here, one goes west about 4 km to reach the mine.

There is a public bus on Route Coloniale No. 3 going to Bac Canh. From the fork onward, the road is not surfaced, but is more than 3 meters wide and in very good condition - easily passable by auto.

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2. Name of Concession and Holder of Mining Rights

This concession takes its name from its location in Cu Van, but it also has been called "Lilith." The holder of mining rights is Mr. George Barondeau, present Managing Director, Indo-China Mining Company, Ltd. Since 1939 the mine has been operated by the Indo-China Industrial Co., Ltd, parent company of this firm. Having finished the mining of the main part of the ore, the company let operations close down from September 16, 1940, until the present day.

3. Terrain

The mine is on a small hill at the foot of the small mountain range of about 500 meters elevation running in a line along the north side of the Tam Dao Range and extending from northwest to southeast between the Red River and the Song Cau. The elevation is 35 meters and the concession is 500 x 300 meters, with its long axis lying northwest to southeast and with an elliptical shape. The tributaries of the Song Cau cut through this vicinity.

4. Geology

According to the "Cao Bang" sector map published by the French Indo-China Government's Geological Bureau on a 500,000:1 scale, the geology of the vicinity of this mine belongs to the Jurassic period in its upper parts and is formed of sandstone and shale. The lower parts seem to be in contact with crystalline schist but are slightly separated. And, a little farther south, rhyolite is found.

In this site, the area has much weathered and fractured yellow-white sandstone and red shale. Around this concession there have been found no outcroppings [of ore?] so that the strike and gradient could not be measured.

To connect this area with the road there must be constructed a trucking road, using the gravel of igneous rock as surfacing. This can be brought from a tributary of the Song Cau, which flows to the east of here.

5. The Ore Deposits and Ore Rock

This ore deposit is made up of large and small ore rocks in the soil above strata of yellow-white sandstone and shale. The major portions have already been mined, and as of today no ore body has been discovered under this.

The ore rocks are found all over the small hill and are partly fine and partly coarse. In general, the north-east part is the richest, while the south part is the poorest. The ore is chiefly hematite, with a considerable amount of magnetite intermixed. The gravel is mostly magnetite. Also, limonite has been formed secondarily from the hematite. The quality is particularly good, with iron constituting over 60% and Silicon oxide, Phosphate and Sulphate in small amounts. The assay, already published in a report is as follows:

Fe	Mn	SiO_2	CaO	S	P_2O_5	MgO	Al_2O_3
65%	0.3	0.5	0.6	0.06	trace	0.2	trace

Assay No.	Specimen No.	% SiO_2	% Fe	% Mn	% S	% P	Notes
55	A 85	1.29	67.29	0.04	0.24	0.01	Mn rich Ore
56	A 86	1.90	64.92	0.49	0.11	0.04	Wad (Bog manganese)
57	A 87	0.36	66.29	0.48	0.10	0.08	Center digging traces
Averages		1.18	66.16	0.33	0.15	0.04	

(Taiwan Government General Industrial Laboratory; Assay: 1942)

In part of the lump-ore body there is a very rich manganese content, this being particularly true in the mine tailings on the eastern slope, where manganese wad is seen in places. The manganese is said to amount to 5%. About 1 meter below the ground there is manganese wad about two meters thick, forming a belt along with hematite. And, we observed outcroppings of this - many centimeters thick in many seams.

Closely checking the ore lumps in the mine tailings, we found that there is red-brown clay at the center with fine crystals of quartz mixed in, occasionally with some weathered pyrite, too.

At sites several kilometers away, there is quite a lot of pyrite in the sandstone; and we observed aqqaurtz vein containing pyrite. In the gravel on the access road to the main road from the mine there are pieces of dioritic igneous rock, brought from the nearby river. According to the map, there is also rhyolite, which leads to a consideration of the origins of this deposit:

This ore deposit is connected with the eruption of the above-noted igneous rock, and the pyrite-permeated ore beds formed between the strata of sandstone and shale are secondarily exposed and remnant deposits.

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6. Amount of Ore

From the start of this mine in 1938 until it wasabandoned in January, 1940, 55,000 tons of iron ore were taken out. So, to ascertain the amount of ore before mining:

Area containing lump ore $300 \times 150m = 45{,}000m^2$

Though the thickness of the zone of lump ore was reported to be 4 to 6 meters, we observed the average to be 2 meters; so the volume is

$45{,}000 \times 2 = 90{,}000m^3$

As the proportion of lump ore is 20%, there were $18{,}000m^3$ of ore. Since the specific gravity is 4, there were 72,000 tons. But, since much of the ore has already been mined, the remaining ore is in a low proportion in the soil and could not profitable be taken out.

7. Mining and Removal

This mine was mined by the terrace method, but to move the excavated earth to the dumps human labor, not mechanical labor, was used.

From the road to the mine is 500 meters, with an auto road built over this distance. From this mine to Ba Son at the foot of the hill is about 3 km. From Ba Son to Thai Nguyen is about 10 km, covered by the Phan-me Coal Mining Company's railway. At Thai Nguyen the lighters are loaded and go on down the canal to Haiphong. The freight rates from Ba Son to Thai Nguyen are 0.90 piasters per ton.

8. Method of Development

If the remaining ore rock is to be dug out of the dumps by the local people in their spare time (Since the dumps already have been worked through twice, the maximum of recoverable ore is about 2,000 to 3,000 tons [English tons], this should be hauled to an agreed location and bought by the cubic meter (figuring 2 tons to the cubic meter), and then hauled away when a considerable amount has been collected. If 1.80 to 1.90 piasters is paid for each cubic meter, the per-ton cost at Haiphong would be as follows:

Trucking (& loading) from point of orgin to Ba Son	0.90 per ton
Same - unloading	0.18
Ba Son to Thai Nguyen - by rail	0.90
Same - unloading	0.18

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Thai Nguyen to Haiphong		1.70
Same - unloading		0.13
Overhead, etc.		1.20
	Subtotal	4.64 [sic]
Commission		0.95
	Total	6.14

9. Conclusions

This ore deposit occurs under the soil on an elliptical hill 35 meters high and 300 meters in diameter, and it is the remnant of an ore outcropping. The amount of ore is about 7,000-8,000 tons - a small deposit - but it is located conveniently close to, and has the use of, the Phan-me Coal Company's railroad. The ore contains an admixture of magnetite with hematite and is of good quality; and there is also a considerable manganese content. With these favorable conditions, it was worked for several years after 1938 by the Indo-China Industrial Company, which removed a major part of the ore - some 50,000 tons - and left the mine idle.

The amount of ore remaining is not great, so that the conditions for extraction are not good; and there would be no value in resuming large-scale operations here. But, if the remaining ore is to be extracted anyway, the policy of using the idle time of the natives and collecting and buying the ore from them should be followed.

(5) The Phuc Linh Iron Ore Deposits

1. Location and Communications

This area is 20 km WNW of Thai Nguyen city. From Thai Nguyen one goes out Route Coloniale No. 3 10 km to the road fork at Cu Van, taking the Cu Van branch and going on for 4 km to the Cu Van mine. From here one goes on another 6 km to reach the minesite.

The ore deposits are three in number: the B deposit is on the road, while A and C each are 150 meters from the road.

2. Concession Relationships

As this area is in the still undeveloped Thai Nguyen Reserve Area, no concession has been set up and there is no holder of mining rights. It is not clear what the name of the ore-deposit area is from asking of the natives, so we have temporarily taken the name of the neighboring region shown on the map.

3. Terrain and Geology

This ore deposit is located between the road and a small hill: the A deposit is at 60 meters elevation, C is at 40 meters, and the B deposit is in a bamboo thicket on the flatland beside the road. All three are arranged in a straight line running from east to southwest. A and C are on a gently sloping hill, A being hidden by dense woods and bamboo growth while C has been cleared off and is now over-planted with tea.

The strata forming this area are recorded by the "Cao Bang" sector map as being of the Jurassic period and are made up of sandstone and shale. The sandstone of the region is brownish yellow and somewhat coarse. Since the ore is mostly hidden in dense woods and very markedly weathered, no outcroppings were discovered; and the strike and gradient could not be measured; nor was the structure and other information clear. Near to D 2 across the valley to the north of the area there is what appears to be a vein of quartz, as well as an outcropping of mottled quartzite and sandstone. Both are infused with pyrite; and we observed one part where this had changed into limonite.

4. The Ore Deposits and the Ore Rock

The A deposit is only on the west side of a 60-meter hill, with iron ore boulders being scattered about. Near the top of the hill the boulders are small, less than 0.3 meters in diameter, but very abundant. From about 40 meters there are 1.5-meter hematite boulders of good quality. And, at the bottom there are mixed in ore rocks rich in manganese - nearly manganese ore - and limonite.

But, there are many locations without ore boulders, so that with the rather general admixture of sandstone pieces there would be much tailing in the mining operation, and ore dressing would be necessary. The ore is mostly hematite, but is a fine quality ore containing limonite, specular iron and goethite also. By naked-eye observation we place the iron content at 55%; and sometimes there is a heavy admixture of manganese.

In the center of the A deposit there are small pieces of hematite occurring among pieces of gangue quartz.

The B deposit is in a 150-meter-square bamboo thicket at the roadside, being made up of large numbers of 0.3-meter diameter ore boulders - sometimes reaching a size of 2 meters. The ore rock is limonite and manganese of good grade.

The C deposit is in a tea planting to the south-west of the road on the south-west slope of a 40-meter hill. Somewhat down from the top of the hill there is a large ore boulder 5 meters x 5 meters x 6 meters = 150 cubic meters, or 600 tons; but this is not believed to be a part of an ore outcropping. Nearby are about ten rocks of 2 to 3 meters in diameter, which probably rolled down from the larger boulder. In the valley below is sandstone. The ore is mostly hematite, with limonite occurring in it - believed to be of a grade above 55%.

Assay No.	Specimen No.	% SiO_2	% Fe	% Mn	% S	% P	Notes
52	A 60	0.92	65.13	0.08	0.12	0.09	Loose-rock A Deposit on bamboo-covered hill
53	A 63	1.53	25.75	24.27	0.11	0.39	Same
54	A 76	2.88	60.13	00.21	0.25	0.16	Outcropping C deposit on tea-planted hill

(Assay by Taiwan Government General Industrial Laboratory, 1942)

The A, B and C ore deposits of this area have become outcropping remnant deposits and are recognized as having been formed secondarily through the permeation of iron-pyrite ore into sandstone. In the A deposit, hematite occurs with quartzite. In D there are quartz veins rich in pyrite which are quartz-quality sandstone outcroppings. And, also in the ore boulders of the C deposit there is pyrite in the center of the white quartz remaining, while the outer shell has changed into hematite.

5. The Amount of Ore

Since these ore deposits crop out and are weathered remnant ore deposits, we do not presuppose the existence of any ore body, but estimate only on the basis of the ore boulders. As the thicknessoof the zone of boulders was not tested, we call this dimension 2 meters - taking the nearby ore deposits as our example.

(1) A Ore Deposit

Area of region of distribution $250 \times 150 = 37{,}500m^2$

Volume $37{,}500 \times 2 = 75{,}000m^3$

Ore content is 10%, and specific gravity, 4.

Est. amount of ore $75{,}000 \times 0.10 \times 4 = 30{,}000$ tons

(2) C Ore Deposit

Volume of Ore-boulder part $70 \times 60 \times 2 = 8{,}400m^3$

Ore content is 20% and specific gravity is 4.

Amount of ore $8{,}400 \times 0.20 \times 4 = 6{,}720$ tons

Therefore, the overall total is:

Estimated amount of ore - 38,720 tons [sic];about 40,000 tons

Considering mineable portion to be 50% of this: 20,000 tons

6. Development and Transportation

The amount of ore in this region is estimated at about 40,000 tons, with no more than half of this being mineable. And, with its distance from Thai Nguyen of about 19 km making considerable capital investment necessary, the company that is to mine it (temporarily the Iron-ore Mining Company) naturally hesitates to begin direct mining, preferring to let the peasants work on their own during their idle time. The company loans them tools and explosives and transports all the mined ore to one place (Phan-me) and decides how much will be paid per cubic meter of ore.

However, under this system it is difficult to predict very much ore production; perhaps it will amount to 300-400 tons a month. The weight of one cubic meter of mined iron ore is about 2.2 tons, but it is figured as 2 tons and priced at ¥2.50 to ¥3.00.

7. Conclusions

This ore deposit is between two roads passable by bicycle [sic], so that the communications are extremely convenient. And, the railway used by the Phan-me Coal Company from Ba Son to Thai Nguyen is available. But, still transportation by car or truck is necessary for 10 km. The quality of the ore is good, being estimated at about 55%. It is accompanied by manganese; and there is an admixture of sandstone pieces - giving it the disadvantage of requiring sorting. The estimated amount of ore in all three deposits is about 40,000 tons, with no more than 20,000 tons mineable.

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Direct, large-scale mining is not called for; but, using the local natives free time, the mining could be accomplished and the ore purchased from them.

(6) The Nui Trang Hoc Iron Ore Deposit

1. Location and Communications

Nui Trang Hoc is located 18.5 km northwest of Thai Nguyen city, Thai Nguyen Province, Tonkin State. It is 4.5 km north of Phan-me on a small hill of 100 meters elevation. The ore deposit starts on the south slope of the hill adjoining Route Coloniale No. 3. This highway from Hanoi, through Thai Nguyen to Bac Kanh passes right by the foot of the hill on the south and is travelled by public bus, so that communications are convenient.

2. Concession and Holder of Mining Rights

This ore deposit is an undeveloped area located within the Thai Nguyen Reserve Area and to date has not been too well known. Therefore, no concession exists, and there is no rightholder.

3. Terrain and Geology

This area is part of a low, hilly belt of the Song Cau basin in the north part of Thai Nguyen. It constitutes one of a group of hills of about 100 meters elevation; among these it is comparatively isolated and steep. According to the 500,000:1-scale "Cao Bang" sector map, the sandstone strata forming this vicinity belong to the Jurassic period of the Mesozoic; but within the scope of our explorations we saw no single outcropping of the strata so that the structure and other details are not known. Still, observing the loose rock, we learned that there is reddish-yellow sandstone of medium grain and soft quality.

4. Summary of Ore Deposits and Ore Rock

This ore deposit is distributed on the south slope of Hui Trang Hoc from near the foot of the hill to within 70 meters of the top, this being made up of loose ore rocks. Cutting through from the valley behind the farm located here, one goes up the hill, observing right away accumulations of large boulders of limonite ore 1 to 1.5 meters in diameter. These extend from around 25 meters to 40 meters elevation. Near to 50 meters the ore rocks become smaller, with a diameter of 10-15 centimeters. Near 55 meters there are again boulders several meters in diameter; but they are practically sandstone and not of good quality. From here sandstone pieces gradually become admixed with the iron-ore rocks until at 70 meters there are none but sandstone rocks.

The ore is chiefly limonite, but with some hematite mixed in. The grade is comparatively low - around 4% [sic]. But, the assay revealed considerable manganese content.

Assay No.	Specimen No.	% SiO_2	% Fe	% Mn	% S	% P	Notes
80	A 62	1.04	38.90	21.68	0.08	0.04	

(Assay by Taiwan Government General Industrial Laboratory, 1942)

In this ore deposit there is nothing that could be considered an outcropping, and probably it is actually just ore remnants of an outcropping.

5. Amount of Ore

By this survey, the area of distribution of the ore in this deposit was found to cover 500 meters east and west and 250 meters north and south on the south face of Hui Trang Hoc. There is a possibility that this area extends on farther to the east and west, but because of time limitations and staff limitations this was not explored.

Area of distribution $500 \times 250 = 120,000 m^2$

Since no test trenches or pits were dug to check the depth of the ore deposit, we do not know how deep it goes; but we take it for two meters, as in nearby deposits of this type. The ore content is 20% of the volume, and the specific gravity is 4.

Estimate of amount of ore $125,000 \times 2 \times 0.2 \times 4 = 200,000$ tons

Mineable portion - 60% of this, or 120,000 tons

6. Development

If the estimated 120,000 tons are to be mined from this deposit in a five-year period, 24,000 tons a year, 2,000 tons a month, or about 80 tons a day must be mined. The prospecting and mining methods would be about of the type established for Dhai Khai.

The mined ore would be transported 4.5 km to Phan-me over a push-cart line. From there, the Phan-me Coal Mining Company's railway would be used for hauling to Thai Nguyen.

Wages/ton for mining ore	2.00
Freight from mine to Phan-me	0.90
Loading and unloading	0.25
Cost from Phan-me to Thai Nguyen	1.00
Loading and unloading	0.10
Lighterage from Thai Nguyen to Haiphong	1.70
Same - loading and unloading	0.15
Offices, miscellaneous expenses	0.30
Total	6.40

(These, however, are costs per ton of ore to the Haiphong storage depot.)

7. Conclusions

This ore deposit is made up of the remnants of an outcropping; it is limonite of poor quality. But, there is considerable manganese content. It is reached by cutting a trail through from Route Coloniale No. 3. And, it has the convenience of being able to use the railway of the Phan-me Coal Company 4.5 km away. The amount of ore only within the limits of the area surveyed is estimated at 200,000 tons, with 120,000 tons mineable. And, there is a possibility that it extends on to the east and west where we did not explore.

The conditions for development are relatively easy, and for transportation there are the national highway and the already constructed railway available for use. Development of this area deserves to be fully considered.

However, the survey of this area to date has been no more than an extremely inadequate exploration, because of circumstances of time and staffing. With this insufficiency of data, a detailed survey of this vicinity will be necessary hereafter.

CHAPTER III

THE IRON ORE OF THE RED RIVER DRAINAGE BASIN

Period of Survey	November, 1941 to January, 1942
Surveyors	Iron and Manganese B Team
Team member	Saito, Masaji Technician, Geological Survey Office of the Trade and Industry Ministry

Section 1. Summary

The outline of this survey of the mines and ore deposits carried out in the Red River Basin is as on the attached table.

The ore deposits are all small scale, and because of their location are of low industrial value. The Thack Khoan mine and the Tang Ma mine are already being worked, but cannot be expected to produce a large amount of ore in the future. However, both the Tuyen Quang and the Thanh Ba mines run up ore-production costs higher than the current price of the ore. Under present conditions a profit is impossible. If these ore mines are to be developed for supplying Japan with ore from French Indo-China under the present shortage of raw ore, it will be necessary to find some means of making a psecial arrangement on the fixing of prices, in view of the production costs.

Section 2. Introduction

The iron ore of the Red River Basin was surveyed twice: from November 25 to December 13, 1941, and from December 27, 1941, to January 17, 1942. What is here called the iron ore of the Red River Basin is that in the basin of the Red River and its tributaries, the Black River (Riviere Noir) and the Riviere Clair, excluding the iron ore of the so-called Thai Nguyen region. Those surveyed this time were the eight iron ore deposits of Ba Xat, Bao Ha, Kien Lao, Thanh Ba, Thack Khoan, Tang Ma, Sangvan and Tiyen Quang in this area. Also included in this area are the already known iron-ore producing sites of Tri Hut, Phu Duc, Phu Doan, etc., but they were omitted from this survey. The location of these ore deposits is as shown on the appended maps.

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Section 3. Discussion and Conclusions

1. The Ore and Kinds of Ore Deposit

Of the Red River Basin iron ores, the deposits surveyed this time all were fractured remnants of ore deposits, and thus so-called loose-rock ore deposits. Through the effects of weathering, the original ore deposit and the loose rock mixed into the top soil. And, there are but a few original ore deposits observable now.

The ore deposits are classified into the following two types according to the kind of ore rock:

(a) Ore deposits of magnetite and hematite (chiefly specular iron ore)

Those belonging to this type of ore deposit are the deposits at Ba Xat, Bao Ha, Kien Lao, Tang Ma, Sangvan and Tuyen Quang. The rock is chiefly a mixture of magnetite and specular iron ore. However, the ore of the Kien Lao deposit does not contain magnetite and is almost entirely specular iron ore. And, the deposit at Sangvan is almost entirely composed of hematite. There are cases where there is a small content of limonite, but these are limited to secondary ore on the surface of the outcroppings. Except for these original ore deposits, the ore is all hard and consequently fine grain. As for ore in veins, there is only the very small amount contained in quartz. The grade of ore is exceedingly good, being mostly more than 60% iron. And, in the ore of the Bao Ha deposit, besides the quartz there is often a very fair amount of such vein minerals as mica, chlorite and epidote, but they are of a poor grade. Also, in the Kien Lao deposit there is a considerable amount of pyrite in the loose ore rock, and the sulfur component is up. Also, in the Tuyen Quang mine there is a deposit of magnetite with pyrite on the surface, though almost no pyrite can be seen in the ore deposit. Sometimes these deposits are of high grade, but in general they mostly are permeated ore and contain veins of other rock or ore in matrix, with a correspondingly low grade of ore.

This kind of ore deposit is observable according to the conditions of geology and of the ore. The outcroppings of igneous rock near to the deposits are mostly of an acid character, or of a bse-salt character. Also, the matrix rock from which the ore deposits are formed are mostly mica schist and quartzite of the so-called Red River bank crystalline Schist system. But, it is also sandstone or limestone of the palaeozoic strata. Consequently, we were unable to confirm whether or not these ore deposits all belong to the same metallogenic province.

(b) Limonite and Specular Iron Ore Deposits

Those belonging to these types are the ore deposits at the Thanh Ba and the Thack Khoan mines. The ore rock is mostly made up of limonite, with some specualr iron ore mixed in. Most of it is fine grain, but there commonly is also coarser rock. The ore rock has some of the matrix mixed in and is mostly not of good quality. However, that at Thack Khoan averages around 54% iron. Also, there is some manganese mixed in with the ore.

The original ore deposit if the Thack Khaon mine is iron-sulfide ore formed by permeation and metasomatosis of the matrix. After this was crushed and exposed to acids, the present loose-ore deposits of limonite were created. The Thanh Ba mine's original ore deposit cannot be directly deduced, but from looking at the limonite ore bodies formed in the strata of the mine, it seems that the ore rock of the loose-ore deposit has fallen from some kind of ore body. Thus, both of these ore deposits are secondary deposits derived from some original natural ore deposits and are not a so-called red-earth form of limonite ore, which exists in various parts of these tropical regions.

2. Scale of the Deposits and the Amount of Ore

The ore deposits are mostly made up of loose rock, and there are no large-scale original, natural ore deposits. The present deposits are the result of the shattering and falling of the original deposits, occurring to an unknown extent above and below the surface of the ground. It is even possible that originally all were small scale, for most [of those remaining] are almond-shaped or vein-form small ore bodies, but again mostly of poor quality. The area of distribution covers a very considerable range, but the density of occurrence is not measured, since they are very roughly scattered. But, the depth of the top soil bearing the ore is usually around 2 to 3 meters. Except for one part , the ore content of the soil does not reach 1 ton/cubic meter, mostly being barely 0.2 to 0.7 tons. Also, there are not a few cases where there is no ore rock on the soil, but just ore scattered over the surface. Still, we can compute the amount of ore at Thanh Ba at about 125,000 tons as a maximum.

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3. Conditions for Developing the Mines

As in the previous section, the amount of ore in each mine is small, so that in the ore deposits there are not a few with no value for development. And, also the small scale of the operations permits no real attention to be given to mining them. The developmental preparations, then, require that the needed capital not be expended on any single mine, but instead should be planned for sharing around with the other mines, too.

The Thack Khoan mine is now being worked. And, as the amount of remaining ore is small, a large amount of ore production may hereafter not be expected. If, nevertheless, efforts are made in the future to increase production, a yearly production of about 30,000 tons could be possible. The Tang Ma mine has already come near to the point of exhaustion, and its future rate of production should be very small.

If, besides these working mines, the as yet undeveloped mines are to be judged by such criteria as the condition of the ore rock itself and of the ore deposits, the amount of ore, the ease or difficulty of hauling the ore to port, etc., the order would be (1) Tuyen Quang Mine and (2) Thanh Ba. Besides these, there are four ore-producing sites, none of which are worth developing.

The ore deposits of Tuyen Quang and Thanh Ba each are somewhat different from the other, but both generally would be easy to mine, and the land transportation would be relatively short, and thus easy and convenient. They have the convenience of access to barge hauling on the rivers. The only deficiency is that this water transportation would be over a long distance and thus expensive. The fact that the amount of ore is not great is a basic problem. These points are exactly the main reasons for these deposits not having been developed to date. This especially applies to the Tuyen Quang mine, though it is to be regretted in view of the extra fine quality hematite and magnetite ore that it is left idle. Both mines, judged from the delivered-in-Japan price of their ore, of about ¥27, would be unprofitable under present market prices. Now, if the price of the ore were to be set in accordance with production costs of these mines, or if a policy could be instituted of providing subsidies, it would be possible to realize the development of both mines. And, the Tuyen Quang mine then would be able to supply Japan with ore for about three years, while the

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Thanh Ba mine could supply ore for about four years, for a total of about 30,000 tons each year.

As a statement on the limits of the results of the survey of iron ore in the Red River basin, it can be said that there would be ~~is~~ no uniformity to the market price for ore in French Indo-China following development of the deposits. In view of the production costs of each mine, it would be necessary to have a policy of setting the prices as much as possible within the limits dictated by conditions at each mine. At the same time, the development of small mines would proceed in all areas; and while the amount of ore produced by each mine would be fairly insignificant, all mines put together would produce a considerable amount.

Section 4. Discussion of the Ore Deposits

I Ba Xat Mine (Appended Figures Nos. 2 & 3)

1. Name of Mine

The mine is called Ba Xat.

2. Concession, Holder of Mining Rights, and History

There are the following four prospecting areas:

Prospecting Area	Number	Name of Same	Date Registered	Holder of Prospecting Rights
Lao Kay	838	Loc Hai	Apr. 11, 1941	Alfred Savallée
Same	839	Lar Moi	Same	Same
Same	840	Bar Coc	Same	Same
Same	841	Ner Pasat	Same	Same

Of these, the known iron-ore deposit is that of the No. 841 prospecting area. This mine would be a small-scale operation, but it has not been worked.

3. Location and Communications

This ore deposit is in the Bar Vuoc section, Ba Xat village, Lao Kay Province, Tonkin State. Ba Xat is about 18 km north-west of Lao Kay right on the Yunnan Province border of China along the Red River. Here, too, is the garrison of the French Indo-China military border patrol. The iron ore deposit is about 3 km north-west of this garrison on a hill abutting the Red River.

Between Hanoi and Lao Kay is 291 km of railroad, requiring 10 hours for the trip. Between Lao Kay and the military garrison at Ba Xat the distance

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can be covered by car in about $1\frac{1}{2}$ hours. Over this distance the road is 3 meters wide and is level; but for frequent use by trucks, it will be necessary to do some repair on the road surface and bridges. The road between the Ba Xat garrison and the site of the ore deposit is passable by horse cart, but it is not suited to auto traffic.

4. Terrain

The Ba Xat region is encircled by high mountains; the Red River cuts through these in deep gorges. But, the sections directly by the Red River are a lowland of gently sloping hills, showing an aged topography. The ore deposit is located on such a hilly spot. On the hills in the vicinity of the ore deposit only reeds and various grasses flourish, trees being scarce. The vallies are generally open and broad and form marshes or paddy land.

5. Geology

According to the 500,000:1-scale Cao Bang geological map, this region is broadly developed from the so-called Red River shore crystalline schist system. Also, it is of the Tertiary system.

Within the scope of this exploration, the geology of the vicnity of the ore deposit is made up of strata of mica schist, granulated granite and alluvial strata. The mica schist is chiefly made of seracite schist and biotite schist. Interspersed with these is quartzite. The strike is N30°-45°. The gradient is generally severe and part of it is to the southwest or northeast. Part of the biotite schist is in the form of injection mica schist. The granulated granite penetrates the strata of mica schist, and on the west side of the ore deposit it covers a broad range. The rock is gray-white in color and slightly granulated. It is generally coarse grained, but that part in the immediate vicinity of the rock formations is finer grained and thus mottled. The alluvial strata are distributed in the vallies.

6. Ore Deposits

The ore deposit occurs in the top soil as a so-called loose-rock ore deposit. The deposit is divided into several locations becauseit is cut across by sections basically lacking ore, or paddies and marshes. These sites all have a strike corresponding to the rock strata below the surface, extending northwest to southeast. And, it is arranged along the boundaries

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of the mica schist and quartzite. The ore boulders are mostly from the size of a calf to the size of a human head. The surface of these is fairly smooth, but their overall form is slightly angular. They have not yet incurred major denudation. The amount of ore content in the top soil varies greatly according to the section, but the average volume is one eighth, so that in a cubic meter of earth there would be 0.55 tons. (The specific gravity of the ore is 4.5.) The top soil containing the ore rock is mostly decomposed mica schist. The amount of rock fragments is not small, and the alrger rocks are almost all iron-ore rocks. The thickness of the topsoil, judging from that along the road cuts is from 1 to 3 meters, averaging 2 meters.

It is not possible to see anything now of the original ore deposit from which this loose-rock ore deposit derives. But, on the basis of the topographical conditions of the deposit and of the universal angular form of the ore boulders, we judge that the rock has not moved in from far off; and the possibility is not slight that the original ore deposit is hidden under the top soil which contains the loose-rock deposit. However, the separation of the loose-rock ore deposit into many locations means that the amount of ore contained in the top soil is generally low. Also, not only is the top soil generally thin, but also no outcroppings of the original ore deposit can be seen. From this we judge that the dimensions of the original deposit must have been very small scale.

7. The Ore Rock

The ore rock is chiefly magnetite, with a small amount of hematite admixed. Occasionally it contains quartz, but for the most part there is no gangue.

The assay values for the ore rock are as follows:

Serial No.	Mine or Deposit Name	OW	Fe	Mn	SiO_2	P	S	CaO	Al_2O_3	MgO	TiO_2
1	HaXat Depos.	1.10	69.40	0.16	0.53	0.049	0.007	[illegible]	0.62	0.14	trace
2	"	2.47	67.40	0.06	1.09	0.029	0.037	0.20	0.59	0.14	"
3	"	2.02	68.80	0.18	0.68	0.034	0.020	0.25	0.84	0.14	"
4	"	0.72	69.80	0.06	0.78	0.032	0.008	0.25	0.86	0.14	"

（八幡製鐵所分析　昭和17年）

(Assay by the Hachiman Foundry, 1942)

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8. Origin of the Ore Deposit

The loose-rock ore deposit is a fragmented and crushed remnant deposit formed by ~~the~~ shattering effects on outcroppings of the original deposit of small almond-shaped ore rock originating in the strata. The original deposit cannot be seen now, and outside of a small quantity of quartzite in the ore rock there is almost no gangue to be found. Thus, the origins have not been settled; but hypothesizing indirectly from the geology, the conditions of the loose-rock ore deposits and the characteristics of the ore rocks themselves, we feel that perhaps this was a contact ore deposit connected with the permeation of granulated granite.

8. Amount of Ore

The scale of the original ore deposit must have been very small; and we do not expect the known deposit to be increased to an amount of ore sufficient for working. From the overall viewpoint of the mining value of this ore deposit, we conclude that this has but very slight significance. Therefore, we give only an estimate of the amount of ore in the loose-rock ore deposit.

Surface area of deposits	Part A	937m^2
	Part B	1,112
	Part C	15,063
	Part D	5,094
	Part E	812
	Total	23,031m^2

Average thickness of top soil	2 meters
Average ore content/m^3 top soil	0.55 tons

Est. amount of ore 23,031 x 2 x 0.55 = 25,344.10 tons

Since in the ore deposit there are portions where there are no outcroppings of ore rock and where there may be gaps in the ore, we assign a safety factor of 70% and compute the safe amount of ore as

25,334.10 x 0.7 = 17,738.87 tons

10. Conditions for the Development of the Mine

The costs of development are not obvious from the amounf of ore and the location, but we may make the attempt to roughly estimate production costs as follows.

(a) Construction Costs

The ore deposit is close by the Red River. The river is passable to lighters and small boats as far as depth is concerned, but because of the swift currents in several places, it would be impossible to use lighters [barges] for hauling the ore. Consequently, bringing out the ore would have to depend on trucks from the mine to Lao Kay and on the railroad from Lao Kay to Haiphong.

Because the amount of ore is small, the only required facilities would be an extension of the railroad from Ba Xat to the site of the ore deposit, hauling facilities at the site and construction of workers' huts. At the actual site of digging hauling would be by push-carts. The minimum estimate for these things would be 30,000 piasters, requiring a rate of 2,00 piasters per ton for the ore.

(b) Production Costs

Excavation and hauling at minesite	2.00 piasters
Management	1.50
Amortization	2.00
Trucking: Minesite to Lao Kay*	8.50
Railway freight: Lao Kay to Haiphong	8.00
Storage at Haiphong	0.50
Loading at Haiphong	0.20
Haiphong lighterage	0.50
Sea freight to Japan	12,00
	36.20 piasters
Less 5% loss	1.81
GRAND TOTAL	38.01 piasters

From the above it is seen that the cost is about 38.00 piasters, but adding to this the cost of offices in Hanoi or Haiphong and of communications, we get 40.00 piasters - which is quite different.

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* The 8.50 piasters for trucking is high, but the hauling of Lao Kay phosphorus ore now runs 7.50 piasters for the 17 km, so that the cost for the 21 km from the mine to Lao Kay was computed at 8.50 piasters.

11. Conclusions

This ore deposit contains high-grade ore, and mining operations would generally be easy; but the amount of ore is small, and it is far from any port. Further, it would not be possible to haul the ore out from the mine using the Red River; trucks and the railroad would be required. Thus, it would be impossible to operate at a profit. We do not consider this as important for development.

2. The Bao Ha Ore Deposit
(Appended Figures 4 and 5)

1. Name of Ore Deposit

Called the Bao Ha iron ore deposit. Also called the Lang Lech iron ore deposit.

2. Mining Concession, Holder of Mining Rights and History

Ore deposits surveyed this time are in the prospecting areas given below.

Prospecting Area	Number	Name	Date Registered	Holder of Mining Rights
Yen Bay	705	Lang Lech	May 27, 1937	Francisque Muller
Lao Kay	746	Quan Sou	May 28, 1937	Same

The two prospecting areas above are in the process of being recorded as mining concessions. And, in this region - as shown in Figure 4 - there are several prospecting areas, mostly prospecting for iron deposits. As for this ore deposit, French Indo-Chinese authorities had some plans for surveying it, and for some development, but finally gave it up without beginning work. The survey reportsof a Japanese technician is as follows:

Ogasawara, Mitsuo Report of Mineral Survey of French Indo-China (in the possession of the Government General, Taiwan)

3. Location and Communications

The ore deposit is in Lang Lech village, southwest of Bao Ha in Yer Bay Province, Tonkin State. Bao Ha is a station on the Lao Kay-Hanoi railroad about 230 km from Hanoi and may be reached in about 8 hours. It is a major town on the route to the inner region west to Thai Nguyen, along the Bao Ha-Thai Nguyen road. Along the way this road crosses the Red River and a mountain pass of about 500 meters elevation. It can be reached in 3 hours

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of hiking, being about 12 km from Bao Ha. This road is more than 3 meters wide and is easily passable by man or horse; but because of the road surface and grades and bridges it is not suitable for autos.

4. Terrain

In this region the valleys of the Red River and its tributary Ngoi Nhu River run northwest to southeast, being separated by mountain ranges of around 600 meters elevation. It displays the eroded topography of old age. The slopes are precipitous, and there is little flatland. The whole zone holds dense forests of various trees, bamboo, wild banana and reeds and grasses.

5. Geology

The geology in the vicinity of the ore deposit is of the so-called Red River shore crystalline schist system, with strata of gabbro and alluvium. The crystalline schist system is a characteristic formation of the Red River bank region. The strike is generally northwest, and the gradient to the southwest 50°- 80°. The upper part of this system is made up of quartzite in many locations, as well as clay-quality phyllite interspersed between graphite schist strata. The lower part is mica schist strata, mostly sericite schist and double mica schist interposed between the quartzite. The gabbro penetrates the crystalline schist and along its strike are some rock veins. The width of the rock formation in the vicinity along the Bao Ha-Thai Nguyen road is roughly 500 meters. The rock is mostly pyroxene gabbro, but, depending on the location, it shows the variant forms of diorite, amphibo-diorite or serpentine. Also, there are both coarse and fine grained boulder-form rocks. On one part of a cut along the Bao-Ha-Thai Nguyen road there is a small amount of chalcopyrite and iron pyrite. Near to the area of contact between the mica schist strata of the lower part of the crystalline schist system and the gabbro a contact-metamorphosed zone has developed, and all kinds of green schists containing hornblende, chlorite, etc., have formed. And, the quartzite veins (aplite) appear strikingly often.

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Alluvial strata are developed on a small scale in the vicinity of the riparian deposits of the Ngoi Nhu River. And, near to the western pass in the mountain of the survey area is an outcropping of granite.

6. The Ore Deposits

The ore deposits are of the following three kinds:

(a) Small, almond-shaped ore deposits in the midst of contact-metamorphosed gabbro and mica schist, and parallel strata of mica schist near gabbro and mica.

The known ore deposits of this type in the "banana" marsh" (The swamp is so nicknamed for the sake of convenience.) are the No. 1, 2 and 3 ore deposits, and the No. 4 ore deposit in the main part of the Lang Lech marsh. These have a matrix of mica schist or green schist. They extend for about 20 meters, and are small-scale almond-form ore deposits with a width of 50 cm to 2 meters. However, the ore rock contains a large amount of gangue; and while the grade of the ore is poor, there is a considerable amount of it.

These known ore deposits were all found near the river in outcropping rocks. We can assume that in this ore-producing region there are some hidden under the topsoil; but bringing the data together, we feel that there is but a poor chance of a large ore deposit being covered up here.

This kind of ore deposit is held to be a contact ore deposit on the basis of geological conditions, the ore deposits and the ore rock.

(b) Loose-rock ore deposits on the mountain slopes

Loose-rock ore deposits, derived from contact ore deposits such as are detailed above, are distributed along with other rocks in the topsoil. The ore boulders are less than the size of a calf, but occasionally there are individual boulders of ten-odd tons. The scope of distribution is wide, but the density of distribution is very irregular and thus not measurable. And, the boulders of ore are not piled up, but are mostly just scattered on the surface.

(c) Loose-rock ore deposits originating in ore beds

Iron-ore rock has washed into the river, and part of it has washed downstream along with other rocks and piled up. Compared to ore deposited on the mountain slopes, the normal density of deposition is high. As the

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range of distribution is limited to this and the riverbeds, the total amount is not great. The upper half of the Monkey Marsh and the part in the current in the "banana" marsh are the places with the highest density.

7. The Ore Rock

The ore rock is specular iron ore and magnetite. In the loose-rock deposits the ore rock is generally extremely hard and fine textured, so that it is all very high grade, but there is also some quartz, serpentine, mica and epidote mixed in, reducing the grade somewhat. That in the contact-ore deposit is irregular in grade and often contains a large amount of gangue. And, some parts contain but a slight amount of iron-ore rock. Assay values are as follows:

Serial No.	Mine or Dep.	-O W	Fe	Mn	SiO_2	P	S	CaO	Al_2O_3	MgO	TiO_2
5	NaOH Deposit	0.58	60.80	0.12	12.21	0.056	0.008	0.25	0.62	0.14	0.38
6	〃	0.58	66.20	0.04	2.13	0.061	0.011	0.26	0.53	0.14	0.10
7	〃	2.09	46.00	0.21	31.00	0.072	0.018	0.706	2.28	0.48	0.31
8	〃	2.12	49.00	0.24	29.28	0.069	0.015	0.308	0.98	0.40	trace
9	〃	1.06	52.20	0.21	26.06	0.059	0.021	0.148	0.74	0.46	〃
10	〃	0.80	65.20	0.18	6.56	0.093	0.045	0.181	0.56	0.56	〃
11	〃	1.00	56.20	0.19	18.38	0.066	0.010	0.181	0.65	0.65	0.28
12	〃	1.54	62.60	0.27	9.56	0.029	0.015	0.181	6.42	0.32	0.32
13	〃	0.69	62.40	0.15	9.81	0.098	0.011	0.54	0.83	0.25	0.19

(八幡製鐵所分析　昭和十七年)

(Assay by the Hachiman Foundry, 1942)

8. Amount of Ore

The ore of this deposit is distributed over a wide area, but very irregularly and thus is unmeasurable. The amount that can be worked is not small, and while it is difficult to get a precise basis for calculating the amount of ore, a rough estimate within the limits of this survey is made as follows:

(a) Almond-shaped ore bodies

Name of Deposit	Length (meters)	Avg Width (meters)	Depth (meters)	Spec.Gravity of Ore	Amt of Ore (tons)
No. 1 Deposit	30	0.5	10	4.0	600
No. 2 Deposit	30	2.0	10	4.0	2,400
No. 3 Deposit	20	1.0	10	4.0	800
No. 4 Deposit - Poor quality ore not worth computing.				Total	3,800

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(b) Loose-rock ore deposits on mountain slopes

Total area of anticipated distribution range 125,625m^2

Ore beds in marshes and river, within this total:

Monkey swamp	$230 \times 3 = 690m^2$
Lang Lech swamp	$100 \times 8 = 800m^2$
Banana swamp	$525 \times 4 = 2,100m^2$
Reed swamp	$75 \times 2 = 150m^2$
Total	$3,740m^2$

Average Ore content: 20 tons/100m^2

Amount of ore: $\frac{125,625 - 3,740}{100}$ = 24,377 tons or 24,400 tons

(c) Loose-rock ore deposits in river beds

Marsh name	Ore (tons)/m^2	Length of swamp (m)	Avg swamp width (m)	Amount of ore (tons)
Monkey swamp	2.0	330	3	1,980
Lang Lech swamp	0.5	100	8	400
Reed swamp	0.5	75	2	75
Banana swamp	1.0	770	4	3,080
			Total	5,535 tons, or 5,500 tons

Total for the whole mine: Approximately 33,700 tons (est. amount)

This Bao Ha ore deposit has a range occupying a wide part of the Ngoi Nhu east bank region. According to this survey, there is almost no ore in the area of the waterfall marsh on the northwest side of the ore deposit; the deposit in this section is small, but it is all visible. Against this, in the southeast part of the ore deposit the ore can be assumed to be continuous. There may yet be some ore in the unsurveyed area, but to expect a large amount is absolutely impossible.

9. Conditions for Development

In view of the amount of ore and the location, we recognize no mining value here, but until we have referred this on, the development plans would be as follows:

(a) Mining equipment

With a quite irregular deposition of ore and a very complex structure to the mountains, the necessity for setting up the mining face, for enlarging the mining cut and for installing windlass hoists, as well as for hauling out matrix rock along with the ore rock means that not only will construction

$24\frac{1}{2}$

expenses behhigh, but also the operations will face ~~the~~ great difficulty in accumulating the ore in piles and in excavating the earth and rock.

(b) Hauling and transporting arrangements

If the ore os to be hauled out by the road from the minesite to Bao Ha station, considerable improvement and maintenance of the road will be necessary. But, as large-scale hauling will be difficult, there is no choice but to cut through a road for the 9 km on a direct line to Bao Ha station from the mine.

The Red River is quite wide and deep and in some places has a current of 10 km/hour, so that it is only with some difficulty that it is navigable by simple boats. But, it is impossible for lighters to navigate; so there is nothing to do but use the expensive railway.

(c) Construction expenses

As explained above, with the various unfavorable conditions, even putting in only the minimum of equipment will run construction expenses to ¥1,000,000 to ¥1,500,000; thus we cannot recognize even a minimal mining value here.

10. Conclusions

This ore deposit is made of specular iron ore and magnetite ore, so the grade is generally good; but the amount of ore is small, the ore is scattered over a wide range of complex mountainous terrain, and is scattered very irregularly. Therefore, it has no value for mining.

3. The Kien Lao Ore Deposit
(Appended figures 6 and 7)

1. Name of Mine

This is an undeveloped concession and has no mine name.

2. Location and Communications

The concession is in Than-Yen County of Yen Bay Province. For this survey we reached the area by the following route. On the Yunnan Railway 155.3 km from Hanoi is the capital city, Yen Bay. And, to the north 9.8 km is the small station of Co-Phuc. Here we left the train and proceeded on foot along the Red River for 4.5 km and crossed by the ferry (Here the river is 300 meters wide.). Thus, we reached the confluence of the Red

River and one of its tributaries. From here it gradually becomes hilly. For some 8 km we crossed and recrossed the tributary at about knee depth until we reached Kien Lao village. As long as we stayed near the Red River it was flatland, the road was wide and walking was easy. But, from there to Kien Lao it is hilly and densely vegetated, and one rarely even sees the native people on the mountain path, so difficult is the way.

An alternative route for reaching the concession is to get off at Ngoi Hop, the station after Co-Phuc. We were told that one then crosses the Red River and proceeds for some 15 km by mountain trail to Kien Lao (This is according to the Survey Report on French Indo-Chinese Minerals, by technician Ogasawara of the Taiwan Government General). Autos can travel from Hanoi to the above Co-Phuc and Ngoi Hop stations; and the Red River is navigable to here (by specially chartered boat).

3. Concessions and Concession Owner

The four concessions are as follows:

Concession Name	Registry Number	Area	Concession Owner	Date Registered
Pi	764	3 x 3km	Tri Coire	April 25, 1940
Mu	765	"	"	"
Lambda	766	"	"	"
Iota	771	"	"	"

4. Landlords

Most of the land is government owned, but the vicinity of the ore deposits and outcroppings is paddy land and belongs to the local inhabitants.

5. Terrain

The plain through which the Red River winds has an elevation of 40 to 50 meters, but nearer to the ore deposits the elevation gradually increases, though it is still just a hilly area with maximum elevations of 500 meters. Kien Lao village, near the ore deposits, is located in a long, narrow north-to-south depression between the hills. The rivers flow both north to south and east to west, and they flow into the Red River on the east side. The long, narrow topographical feature forms a valley, and the low land is formed when there is a fractured and crushed effect. Kien Lao village is 200 meters high. Most of the basin in which it lies is paddy field; in the center surrounded by paddy fields is a small mound. The ore deposit is in this small mound. The nearby hilly lands are densely vegetated with broad-leaf trees and with dense grass so that it is difficult to get into the hills.

6. Geology

The geology of this vicinity is Devonian sandstone (according to the 200,000:1 Carte Geologique de l"Indochine Francaise), as well as phyllite and quartz schist strata. Near the ore deposit is a small outcropping of Quartz-like limestone. The general strike of these nearby strata is north-west to south-east, with a gradient to the north-east of 45° - 80°.

The basin in which the deposit lies is covered over by diluvial and alluvial strata, with poor rock outcroppings so that there is almost no place where the strike can be measured. Only in the rice paddies to the south of the No. 6 ore deposit is the above-noted limestone to be found. The strike is N5°W, and the gradient is to the east 70° - 80°.

7. Ore Deposits - Outline

The iron-ore deposits form small mounds in the lowlands of Kien Lao. They occur in eight locations, at points for 1 km along a north-south line. The largest of these is the No. 7 deposit, where the mound measures 80 meters from east to west and 30 meters from north to south and rises 2 to 2½ meters above the paddies. The other mounds have a diameter of around 12 meters and are just small mounds rising 1 to 1½ meters above the paddies. The conditions for ore production are the same at all eight sites; the ore boulders run to all sizes in heaps, as recorded on the separate table of calculations of the amount of ore. The largest have a diameter of over 2 meters, while the smaller ones usually do not reach 1 meter in diameter. Occasionally there are large boulders with a diameter of 4 - 5 meters. These ore boulders are hematite, with rough edges and corners and are deposited together with clay and sand in the diluvial strata.
Deposits No. 1, 2, 3 and 4 to the north are admixed with sandstone, believed to be their matrix rock. This condition is found in these northerly deposits. The ore boulders are densely clustered, particularly in the No. 7 and No. 8 deposits. These boulders all could be considered loose rock; and the

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original deposit is nearby in a fragmented condition, so that these must be a secondary accumulatiôn.

From the above data, we surmise that the formation of these ore deposits occurred when the original deposit was shattered along an east-west line (the action which formed the Kien Lao basin). The matrix rock was so crushed that only the harder ore rocks remained. Therefore, such ore deposits should be called "shattered and remnant ore deposits."

Next, as to the origin of the original ore deposit, we have very few reliable data, but we will clarify this in the next section (8).

8. The Ore Rock and the Amount of Ore

If we see this as a remnant ore deposit resulting from some crustal movements, we cannot expect more than the amount of ore shown in the table.

No. 1 Deposit	136.15 tons
No. 2 Deposit	48.60
No. 3 Deposit	44.68
No. 4 Deposit	32.34
No. 5 Deposit	50.94
No. 6 Deposit	258.75
No. 7 Deposit	2,609.00
No. 8 Deposit	396.00
Total	3,536.46 tons

In general the computation of the amount of ore includes the ore boulders occurring above the surface of the paddy fields; the No. 7 and No. 8 ore deposits also include theoore bodies above the surface. However, judging from the previously noted source of the ore deposits, the amount of ore accumulated below the surface must be very considerable, but we can expect no more than the above amount. Therefore, we stick with ourefigure of 3,536.46 tons.

The ore rock is hematite in the following forms: (1) Hard, fine-grain ore of steel-gray color, (2) A crystalline fibrous form and (3) Specular iron ore with metallic lustre. The quality is good, but it has the defect of containing a large amount of crystalline grains of pyrite.

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Chart 3:1

Sketch of Ore Deposit (Ground Plan)

No. 1 Deposit 鉱床

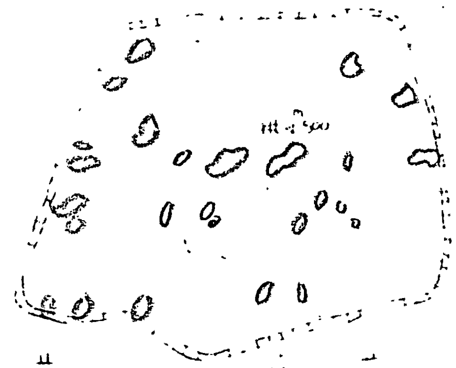
(Heights based on paddy surface)

=1:200

Scale = 1:200

= iron ore rocks

= sandstone



鉱量計算

Computation of Amount of Ore

No 1 鉱床 (Sample 16185)

No. 1 Deposit

10×08×06	0.48 cbm
10×06×07	= 0.42
0.5×0.5×0.3	= 0.075
2.0×[illegible]×1.0	[illegible]
2.0×1.0×1.0	= 2.00
2.0×2.2×2.0	= 8.80
2.0×1.5×1.0	= 3.00
0.5×0.5×0.3	= 0.075
2.0×1.0×1.0	2.00
0.5×0.5×0.5	0.125
1.5×[illegible]×0.5×3	2.25
1.0×0.8×0.8×3	1.92
0.5×0.3×0.5×4	[illegible]
2.5×1.8×[illegible]	[illegible]
[illegible]	[illegible]

30.255 cbm × 4.5 (Spec. gravity)

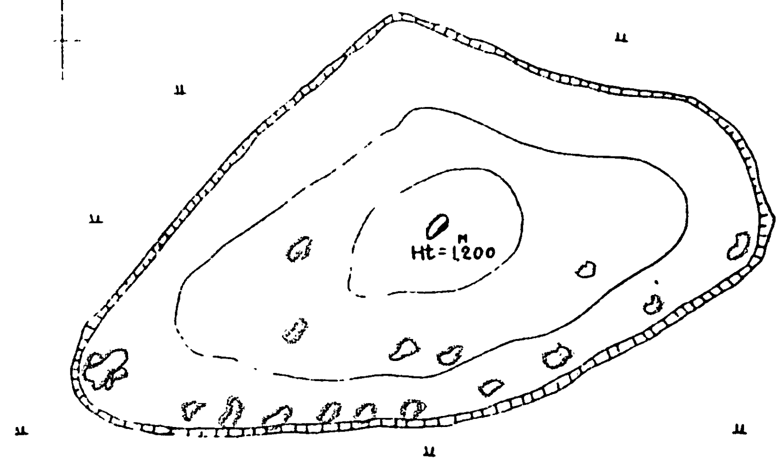
136.3 ton

Chart 3:2 第三図ノ二

Sketch of Deposit (Ground Plan)
鉱床スケッチ (平面圖)

6=1:200

No. 2 Deposit
№2 鉱床



Sandstone
砂岩

Iron ore rocks
鉄鉱塊

Computation of Amount of Ore
鉱量計算

No. 2 Deposit
№2 鉱床 (Sample 185)

Size of Iron ore rocks
鉄鉱塊ノ大サ

1.5 × 12 × 10 = 180
06 cm × 15 = 9.00 } - 10.80 cubm

10.8 cubm × 4.8 (Spec. Gravity) = 48.60 ton

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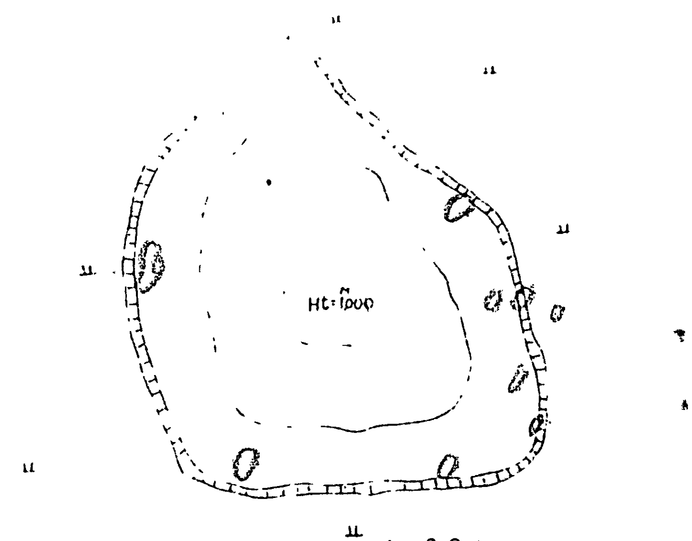
Chart 3:3

Sketch of Ore Deposit (Ground Plan)
(平面圖)

S=1:200

No. 3 Deposit



Computation of Amount of Ore
鉱量計算

No. 3 Deposit
No. 3ノ鉱床 (Sample 184)

Size of Ore Rocks
鉱塊ノ大サ

1.0 × 0.8 × 0.5 = 0.40
0.8 × 0.5 × 0.6 = 0.24
0.8 × 0.4 × 0.6 = 0.16
0.6 × 0.8 × 0.5 = 0.24

Total計 1.04 cubm

∴ 1.04 × 4.0 = 4.16 t.

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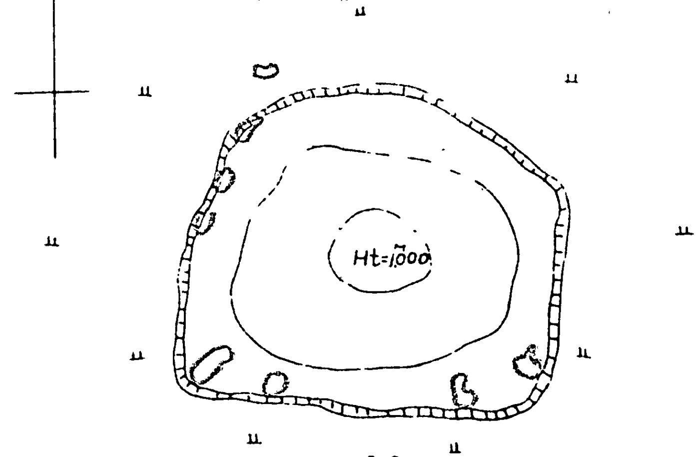
Sketch of Ore Deposit (Ground Plan)
鉱床スケッチ（平面圖）

S=1 200

No. 4 Ore Deposit
No 4 鉱床

O Iron Ore Rocks
鉄鉱塊



Computation of Amount of Ore
鑛量計算

No. 4 Ore Deposit
No 4 鉱床 (Sample 184)

Size of Ore Rocks
鉱塊大サ

$1.0 \times 0.5 \times 0.5 \times 2^{ケ} = 0.50$

$1.0 \times 0.5 \times 0.5 = 0.25$

$0.8 \times 0.7 \times 0.6 = 0.336$

$0.7 \times 0.5 \times 1.0 = 0.35$

$0.3^{\text{cubm}} = 0.3$

$1.5 \times 1.0 \times 1.0 = 1.50$

$1.0 \times 0.5 \times 0.5 = 0.25$

$0.5 \times 0.5 \times 0.5 \times 2^{ケ} = 0.250$

$1.5 \times 1.5 \times 1.5 = 3.45$

7.186 cubm

$7.186 \times 45 = 32.34^{\text{ton}}$

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Computation of Am't of ore

No. 5 Ore Deposit

Size of ore rocks

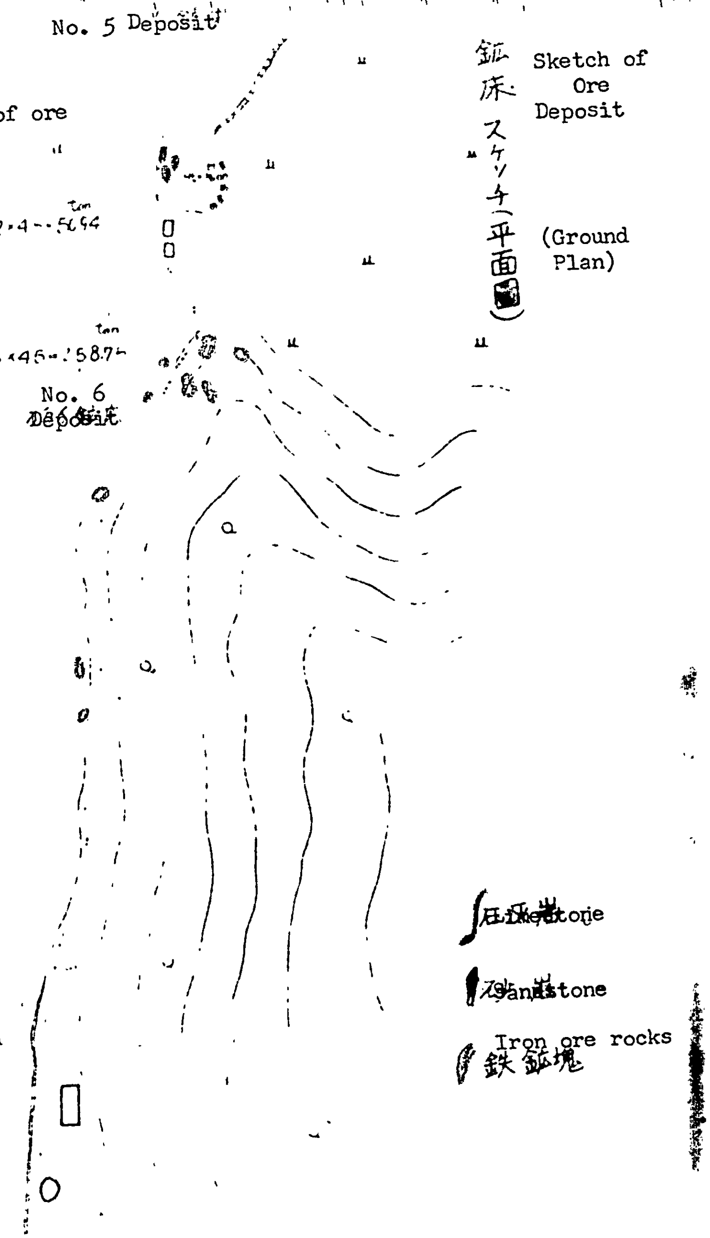
33×24×1[illegible]	=792
20×10×05	=100
20×20×06	=240
10×10×2	=200
06 ×3	=180
30×15×28	=1260
30×30×15	=1350
12×10×10	=120
30×22×3	=1280
24×10×10	=240
20×15×15	=450
15×10×10	=150
[illegible] cub m ×17	=[illegible]

No. 5 Ore Deposit: 1132×4 = 5644 ton

no. 6 Ore Deposit: 575×45 = 258.7 ton

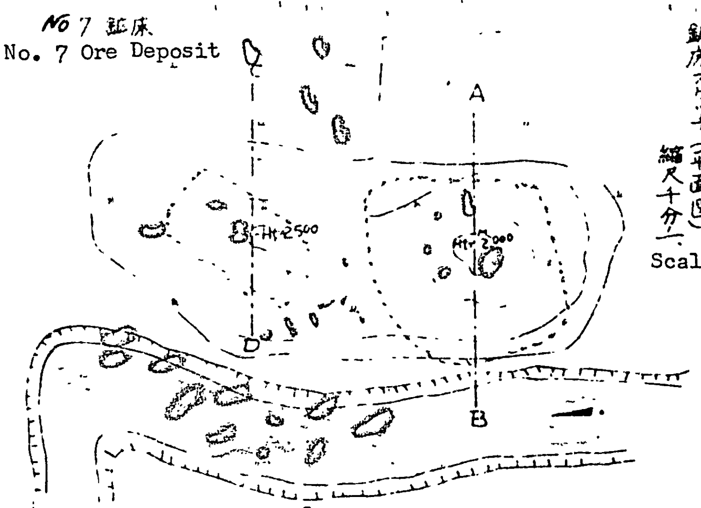
68.82 cub m

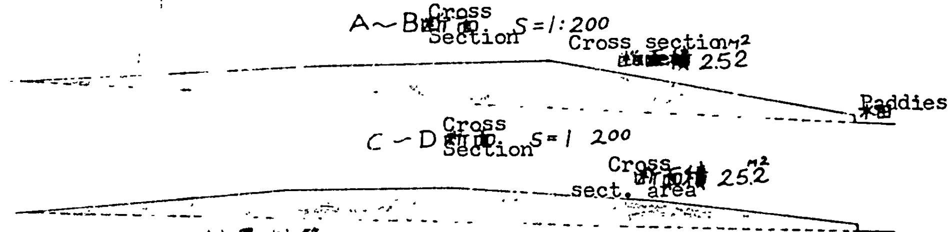
6882×45 = 309.69 ton



No 7 鉱床
No. 7 Ore Deposit

鉱床スケッチ(平面図) Sketch of Ore Deposit (Ground Plan)
縮尺千分ノ一 Scale 1000:1





鉱量計算 Computation of Am't of Ore
No 7 鉱床 (Sample No 183)
鉱塊ノ大 Size of Ore Rocks

東側 East Side
3.6×3.0×3.3 =23.76
2.5×2.0×2.0 =10.00
1.0×1.0×1.0 =1.00
– 34.76 cub m ×4.5 = 156.42 ton

No 7 鉱床鉱塊外鉱量計算 断面 A～B
Computation of am't of ore other than ore boulders of No. 7 deposit
2.55 m^2 ×30 m = 76.5 cub m (Take 1/4 am't of ore as 1/4)
∴ 76.5 × 1/4 – 19.1 cub m ×4.5 = 85.9 5 ton

田ノ中 In midst of paddies
2.0 × 1.0 × 1.0 = 2.00
2.0 × 2.0 × 1.5 = 6.00
1.2 × 1.0 × 1.0 = 1.20
3.0 × 2.0 × 1.5 = 9.00
– 18.20 cub m ×4.5 = 81.9 ton

(裏面) (over)

Chart 3:7

Size of Boulders

1.0×1.3×1.0 = 1.30
2.0×1.5×1.0 = 3.00

West Side 西側
2.0×1.0×1.0 = 2.00
1.5×1.5×.8 = 1.80
2×1.0×0.5 = 0.50 ... 7.7 × 45 = 77.8 ton
2×1.0×0.6 = 0.6
1.5×1.5×0.6 = 1.35
2.0×1.5×1.5 = 4.5
2.0×1.0×1.0 = 2.0

Computation of Am't of Ore Other than in Ore Boulders No.7 鉱床転石以外鉱量計算

Cross section 断面 C~D

252 × 30m = 756 cubm (Am't of Ore taken as 1/3)

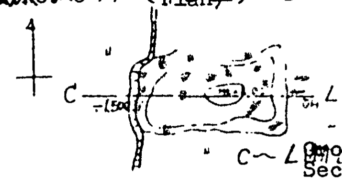
∴ 756 × 1/3 = 252 cubm × 4.5 = 1,134.0 ton

Midst of River 川中
2.5×1.5×1.0 = 3.75
3.4×2.0×1.0 = 6.80
2.5×1.5×1.0 = 3.75
4.0×2.0×2.0 = 16.0
3.0×2.5×1.0 = 10.50
5.0×2.0×1.0 = 10.00
2.0×2.0×1.0 = 4.00
2.0×2.0×1.5×2 = 12.00

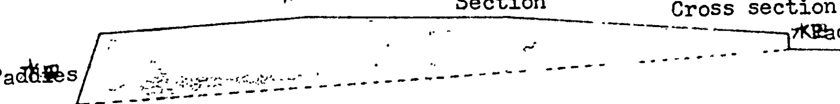
66.80 cubm × 4.5 = 300.6 ton

Total Amount in No.7 Deposit No.7 鉱量合計 2,609.6 ton

Sketch No.8 Deposit 鉱床スケッチ (Ground Plan) S = 1:1,000



C~L Cross Section S = 1:200 Area of Cross section 350 m



No. 8 Deposit No.8 鉱床 (San Pan No.186) Computation of Am't of Ore 鉱量計算

Area of Section 断面積 35.0 × 10 = 350 (Amount of Ore taken as 1/4)

350 × 1/4 = 88.0 cubm × 4.5 = 396.0 ton

The grade is roughly 60-65% iron, 5-7% SiO_2; and while there is but a small amount of poor ore, the large pyrite content means that the sulfur content would probably be over 5%; accordingly it is not sutiable for use as iron ore.

The iron ore boulders in some cases have a crust of limonite ore as a secondary variant form. There are no other minerals in it besides the pyrite and quartz.

9. Outline of Method for Extraction

The large, exposed ore boulders would be fragmented by blasting, making extraction very easy.

10. Ore Grading and Refining

Where the amount of quartz contained is large, it would be possible to handsort; but since the hematite contains pyrite particles, the sulfur component - which cannot be easily sorted out - would be difficult to reduce.

11. Value for Production

As detailed above, this ore deposit (1) has a small amount of ore, (2) has a large sulfur content and (3) is inconveniently located. With these poor conditions, it has no value for development. Consequently, we will omit any discussion of its value for production.

(insert charts)

4. Thanh Ba Mine
(Appended Figures 8, 9 and 10)

1. Name of Mine

The concession has the name Nui Tieu, but it was previously called Thanh Ba by a Japanese.

2. Concession and Holder of Mining Rights

Concession Name: Nui Tieu Date Registered [blank]

Holder of mining rights: Seguit

75 Bd. Henri Riviera, Haiphong

3. Location and Communications

The mine is in Khan Thon village, Cam Khe County, Phu Tho Province, Tonkin State. To reach the mine, one travels from the east bank of the Red River

River near Am Thuong station on the railway to Lao Kay, going by small boat about 1.5 km downstream and then westward up the tributary Ngoi Lao River. About 8 km from the river's mouth, on the south bank, is Khan Thon village. It is reached after about a three-hour journey from Am Thuong. The ore deposit is located about 2 km south of the village.

The Ngoi Lao River is navigable here since the current is slow and the water has sufficient depth for lighters of considerable size. But, about 1 km downstream from Khan Thon the current is fairly swift and in several places there are low rapids. Even the small bamboo river boats can scarcely navigate by towing.

4. History and Present Status

The small amount of ore from this mine has usually been hauled to Haiphong and marketted by the indigenous people. At present, development is going on under the management of the Frenchman, Seguit. A major part of the railway construction - 6.0-ton capacity rails for 2 km from the minesite to the Ngoi Lao River near Khan Thon village - has been completed. On the one hand, they are doing their best to market the ore; but on the other hand they are plagued by such difficulties as the non-navigability of the upper Ngoi Lao by larger boats and the unfavorable grade of the ore. And, they seem very impatient that their dealings have not succeeded. However, the tracks are old material, just like scrap, and will not last long. And, if the traffic is heavy there will be the danger of derailment. So, to achieve any basic improvement in ore extraction it will require fundamental re-equipping.

At present, mining operations are suspended, but at the minesite there are stored about 1,000 tons of ore. And, in the vicinity of the ore deposit several prospecting pits have been excavated.

5. Terrain

The terrain in the vicinity of the ore deposit is made up of (1) the alluvail flatland alongside the Ngoi Lao River, (2) the relatively high hills on the south side and (3) the mountains several hundred meters high, also on the south side of the river. The ore deposits are located at the foot of this mountainous area on the north side. In general the slopes of the hills and mountains are not steep; and trees, bamboo and grasses flourish to form dense woods. The valleys between the mountains and hills are wide and open, most of them having been cleared and made into paddy fields. From the site of the ore deposit to the banks of the Ngoi Lao River the area is mostly paddy field without rises or hollows, so that the site is easily reached.

6. Geology

The geology is made up of Devonian and pre-Carboniferous sandstone, shale, phyllite and quartz strata, and alluvial strata (Cao Bang and Hanoi sector maps, 500,000:1 scale). In part, these strata are disordered, but in general the strike is north-east and the gradient is to the north-west. However, for the most part they are covered by the topsoil so that the details are not known.

7. The Ore Deposits

The ore deposits are so-called loose-rock deposits of limonite and goethite on the surface of the ground and in the topsoil. The ore rock, as shown in Figure 9, occurs in many separate locations. In these, the distribution of the rock is rather dense, these being recorded in the figure as the four sites A, B, C and D, which are of recognized value. In contrast, the areas marked "area of scattered iron-ore rock" have ore only on the surface of the ground, so that these deposits have a very irregular distribution and are valueless.

In the three deposits A, B and C the ore is in the topsoil on the flank of the hill and is fairly near to the surface. Its thickness is generally around 2 meters, though the south-east part of the B deposit is around 3 meters thick, while part of it reaches almost 5 meters.

The topsoil is mainly a yellow-brown color, produced from the base strata of sandstone, shale and phyllite. As the surface of the ore deposits are generally covered by earth, only the larger ore boulders are exposed above the surface so that without excavating pits and shafts the facts of the ore reserve often are difficult to determine. The size of the ore boulders ranges from human-head to bean size; and there may be several tens of tons of ore in rocks some 3 meters in diameter. In the A deposit, already being mined, the ore particles are so small that the volume of the ore amounts

30 only to 67%, or at most 68%. Containing such a small amount of ore, this

deposit will require special planning to mine it.

Finally, from the digging already done, the prospecting pits, etc., the condition of the ore deposits, their thickness and the ore content can be derived.

(a) The A Deposit

In the zone of this deposit at the foot of the mountain there are 13 prospecting excavations, by which it was learned that the ore reserve here amounts to 600 tons.

Working Face No.	Am't Already Mined (m^3)	Am't of Reserve	Ore Content in Soil	Am't of Ore/m^3	Thickness of Ore-bearing soil
1	73	20 T	-	0.3 T	2.1 meters
2	-	-	1/3	0.8	2.1
3	-	-	1/4	0.6	2.0
4	-	-	1/3	0.8	2.0
5	-	-	1/4	0.6	1.5
6	-	-	1/3	0.8	1.8
7	98	64	-	0.7	2.0
8	80	19	-	0.2	2.0
9	56	31	-	0.6	1.8
10	98	50	-	0.5	1.7
11	88	47	-	0.5	1.2
12	86	40	-	0.5	1.8
13	-	-	-	-	(Amount of ore tapers off near edge of deposit)

(Note: Specific gravity of ore is 2.5.)

Past prospecting has seen the small, bean-size pieces of ore thrown out along with the topsoil so that these should be figured in. The amount of this small-size ore rock varies according to the location, but the average is 0.2 tons/m^3. Adding this in (excluding the No. 13 working face), the average content is 0.7 tons per cubic meter. And, the average thickness of the ore deposits is 1.8 meters.

(b) The B Ore Deposit

As with the A deposit, this deposit has mining [working] faces, the reserve here being about 250 tons. Observing the condition of the working faces, we noted the thickness of the deposit to be about 2 meters and estimated the amount of ore per cubic meter at 1.0 tons.

In this ore deposit there are prospecting pits without any set pattern of location. The condition of the prospecting pits iseas follows:

Prospecting Pit Number	Depth of Pit (m)	Condition of Deposit	Ore Content	Ore $/m^3$	Thickness of Deposit (m)
1	4.8	Did not reach bottom of deposit; rock fragments mixed in with ore.	1/3	0.8	over 4.7
2	1.2	Does not reach bottom of deposit.	1/2	1.3	1.2
3	0.7	Same. Generally good grade of ore.	1/3	0.8	0.7
4	1.4	Same. Large ore content.	4/5	2.0	1.4
5	1.1	Same. Same.	4/5	2.0	1.1
6	2.9	Lower 70cm is clay con- containing other rock.	1/3	0.8	2.2
7.	0.6	Soil with shale and quartz fragments, almost no ore at all.	0	0.0	0.0
8	1.0	Small amount of ore in upper part, large amount in lower. Does not reach to bottom of deposit.	1/4	0.6	0.4
9	2.9	Slight amount of ore.	1/10	0.2	over 2.9
10.	0.8	Does not reach bottom of deposit.	1/4	0.6	0.8
11	1.6	In lower 30 cm gray-green phyllite appears	1/4	0.6	1.3
12	1.0	Ore scattered on surrounding ground, none in pit.	0	0.0	0

These prospecting pits, being irregularly located, do not easily permit average figures to be computed. With the inidcated method for recording the amount of ore, the calculations give an average deposit thickness of 2.1 meters and an average ore content of 0.9 tons/cubic meter.

(c) The C Ore Deposit

Just as with the A deposit, there are already prospecting pits. The amount of the ore reserve is about 70 tons. Judging from the conditions of the working face cut, the deposit has a thickness of 1.5 meters and has an average ore content of 0.6 tons per cubic meter.

The D deposit is different from the other three deposits, being a deposit of ore rocks occurring together with sandstone and quartzite rocks on the surface of a narrow valley floor in the midst of the mountains. On the average there is 1.0 tons/square meters. The amount of the reserve is

24

50 tons.

8. The Ore Rock

The ore is limonite and goethite. The former predominates, but the proportion of each changes according to the location. Still, the goethite ore is almost always 20 to 30% of the total.

The limonite ore is red-brown and occurs in breccia form, schist-form and granulated or sponge-like form. Much of it is highly porous, but sometimes it is amorphous with a fine grain. The goethite occurs on the surface of the ore boulders to a depth of several centimeters, or it fills in the crevices in the limonite, producing a vein-like form. This goethite ore occurs as fibrous crystals, black-brown and lustrous black in color and has been collected in both radiate form and bundle form. The surfaces of the ore boulders are butryoidal, kidney-form and mammaform. Often the ore shows distinctive crystals, these sometimes reaching a length of 20 cm. The abundance of goethite in the ore makes the ore of this deposit very rich.

There are some other rock fragments admixed in a small quantity in the ore deposit, this also being the case with the crevices and depressions of the ore boulders. As these other rocks are not easily excluded, the grade of the ore suffers accordingly.

The ore also contains manganese, especially on the weathered surfaces where oxidized manganese occur as a black coating, or in spots and bands.

The assay values for the ore are as follows:

Serial No.	Mine Deposit	C.W.	Fe	Mn	SiO_2	P	S	CaO	Al_2O_3	MgO	TiO_2
14	Thanh Ha Mine	11.00	56.32	0.89	4.37	0.064	0.027	0.19	1.49	0.31	trace
15	〃	10.84	56.78	0.80	4.23	0.034	0.018	0.28	1.68	0.25	〃
16	〃	11.21	56.12	1.09	3.57	0.084	0.087	0.30	2.32	0.31	〃
17	〃	10.46	56.14	1.56	4.46	0.073	0.031	0.24	1.35	0.24	〃
18(A)	〃	4.97	15.80	21.86	25.57	0.103	0.011	0.30	8.52	0.38	0.38
18(B)	〃	8.26	13.80	24.91	19.72	0.130	0.012	0.30	6.92	0.42	0.22
19	〃	9.92	56.00	1.15	3.75	0.066	0.012	0.36	2.47	0.35	0.14
20	〃	11.08	56.20	0.74	[illegible]	0.091	0.027	0.36	1.87	0.37	0.10
21	〃	11.63	49.20	2.27	6.20	0.049	0.024	0.60	6.49	0.39	0.16
22	〃	12.68	50.30	4.22	5.36	0.089	0.040	0.40	3.30	0.30	0.11
23	〃	11.06	55.40	1.68	4.38	0.073	0.021	0.60	2.38	0.50	0.07

（八幡製鐵所分析　昭和十七年）

(Assay by Hachiman Foundry, 1942)

9. The Origin of the Ore Deposit

Near to the twenty or so large ore boulders - weighing from ten-odd tons to several tens of tons - in the southwest part of the B ore deposit there is much loose ore rock. On the lower slope a large amount of smaller ore rocks is scattered. The large rocks are scattered in disorder; those on the upper slope are partly buried and may even be outcroppings. Also, in the upstream part of the D deposit on the valley floor there are seams of quartzite and sandstone-quality shale, following the layer surface of the matrix rock on a strike of N60°E and a gradient of NW15°. The maximum width is 3 meters, and the exposed part extends for 9 meters - an almond-shaped deposit of limonite. As the matrix rock of the deposit is stained with limonite ore, there is no distinct division between the matrix and the limonite; and also there are many places where the matrix intrudes into the ore deposit. In the lower part of this ore body the loose limonite rock is scattered on the valley floor. In contrast, in the uuper part the loose ore rock suddenly decreases. However, the loose ore rock forming the Thanh Ba deposit, as in the above-noted two cases, has fallen down from the original ore body. Still, the origin of this original ore deposit, which supplied these loose limonite rocks, is not yet known. However, it probably derives from a mineralized magma which extruded from underground and formed the ore through oxidizing effects near the surface.

In any case, it is not difficult to surmise that such a limonite ore deposit does not continue deep underground.

10. The Amount of Ore

The amount of ore is calculated from the amount of the ungraded ore, so that small bean-size ore fragments not easily taken out are included. Consequently, dressing of the ore is required to improve the grade of the ore - this then causing some decrease in the amount of ore. A considerable amount of water is included in the ore rock, but the computation of the amount of ore is based on drying this out naturally. Since the specific gravity of the ore is 2.5, the figures below are for the amount of the dry ore. Also, since the prospecting of the ore still is inadequate, the amount of ore depends on assumptions made on the nature of the deposit.

(a) A Deposit

From the conditions in the mining faces already excavated, we judge that it is generally expanding.

Area of Deposit	11,375m^2
Average thickness of deposit	1.8 meters
Amount of ore/cubic meter	0.7 tons
Estimated amount of ore	14,332 tons

(b) B Deposit

The data already known about the B deposit is not adequate, this being particularly due to the irregular location and the great differences in the conditions of deposition according to location. Thus, it is not easy to establish average figures for the different types in the ore deposit as a whole. Accordingly, the calculations of the amount of ore in this deposit are by the methods given below. Thus, as shown in Figure 10, the deposit is a square 100 meters on a side and is arbitrarily divided into sections, with the amount of ore computed for each section. In each case the thickness of the ore deposit and the ore content is based on the data already known from the prospecting pits in the section.

In those sections lacking such data the conditions in adjacent sections and a surface survey of the section enable conclusions to be drawn as to the nature of the deposit and enable the computations to be made from this information.

Section	Area	Depth of Deposit	Volume	Ore Content/m^3	Estimated Amount of Ore
A-II	563m^2	1.5m	844m^3	0.6 tons	506
A-III	4,375	1.5	6,562	0.6	3,937
B-I	63	2.0	126	0.8	101
B-II	5,813	1.5	8,719	0.8	6,975
B-III	7,563	2.0	15,136	1.0	15,136
C-I	937	2.0	1,874	0.9	1,687
C-II	8,750	2.0	17,500	0.9	15,750
C-III	10,000	2.0	20,000	0.9	18,000
C-IV	2,500	2.0	5,000	0.4	2,000

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D-II	3,875	2.0	7,750	1.0	7,750
D-III	10,000	3.0	30,000	1.2	36,000
E-II	7,250	2.0	14,500	0.8	11,600
E-III	1,313	2.0	2,626	1.0	2,626
E-IV	5,688	3.0	17,064	1.0	17,064
E-V	750	1.5	1,125	0.8	900
Totals	69,440		148,826	Total	140,032

Average thickness of B deposit: 148,826 ÷ 69,440 = 2.1 (meters)

Average ore content in B deposit: 140,032 ÷ 148,626 = 0.9 (tons)

(c) C Deposit

Area of deposit	1,000 square meters
Average thickness	1.5 meters
Average ore content	0.6 tons
Estimated amount of ore	900 tons

(d) D Deposit

Length of deposit along valley	130 meters
Average width	4 meters
Ore content/square meter	1.0 tons
Estimated amount of ore	520 tons

Totals for the whole deposit:

A Deposit	14,332 tons
B Deposit	140,032
C Deposit	900
D Deposit	520
Total	155,784 tons (est. amount of ore)

It must be noted that the present data on the A, B and C deposits - especially the central part of B deposit - are inadquate, so that a safety factor of 80% is applied:

Safe estimate of amount of ore: 124,627.2 tons

Distinct from these at the minesite are the following ore reserves:

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Vicinity of A Deposit		600 tons
Vicinity of B Deposit		250
Vicinity of C Deposit		70
Vicinity of D Deposit		50
	Total	970 tons

11. Development of the Ore Deposits

The ore of this mine has an average grade of Fe 42%, or 48% (when the manganese ore is excluded) in the case of the limonite. This would probably be the poorest grade of ore to be imported from abroad. Consequently, should plans be laid for developing this mine as a source of supply for Japan, this point would certainly have to be considered, as would also this ore's strong points of the small refining loss in the case of the limonite and its ability to be refined with but a small amount of fuel coke. And, a particularly essential condition would be that it go to factories with blast furnaces that can handle limonite ore.

(a) The Amount of Ore Extractable

The area over which the ore is distributed is quite wide; therefore, the deposit was divided into three locations: A, B and C-D. While a daily production figure of 300 tons of ore would be possible, it would require hauling over 3 km by a small model 3 to 5 ton locomotive on rails with a minimum load capacity of 12 tons, so that great expenses for major incidental construction, not at all consistent with the size of the deposit, would be required. Thus, there is no choice but to use hand-powered transportation at this deposit; and this would make it difficult even to achieve a daily production of 100 tons, or 30,000 tons a year.

(b) Facilities for Mining, Excavating and Hauling

As the amount of ore is barely 130,000 to 150,000 tons, the facilities for development, especially for hauling and construction materials, would naturally be held to a minimum level, and would be based on the assumption of using them also at other mines, not just at this one. However, compared to the amount of ore, the area of distribution of this deposit is wide and ranges to an elevation of 60 to 70 meters. Thus, to rely solely upon human power for the hauling from the working face would be to decrease extractive efficiency and increase management costs, so that it will be necessary to install two simple hoists. Now, on the basis of a plan for a production of 100 tons daily and 30,000 tons annually, we can work out the following:

(1) Mining

Clearing and burning of forest	10 hec.	ea. 50.00 piasters	5,000.00pi. [sic]
Mining, excavating the mining face	3000 workers	ea. 0.53	1,500.00
Large Ore Bins	3	ea.1500.00	4,500.00
Small Ore Bins	6	ea. 500.00	3,000.00
Hoists	2	ea.2500.00	5,000.00
Hoist installation costs	2	ea.1000.00	2,000.00
6-ton Rails	2 km	ea.4000.00	8,000.00
Related materials			2,000.00
$\frac{1}{2}m^3$ ore cars	20	ea. 500.00	10,000.00
Related materials			2,000.00
Crossing materials			2,000.00
Tools			2,000.00
Explosives			2,000.00
		Sub-total	49,000.00

(2) Transporting and Hauling

The present cancers for water transportation are the shoals of the upper Ngoi Lao River. The rails now being installed reach some 500 meters below Khan Thon village, but when they have been extended one kilometer more the problem of the shoals should be solved. The summary of construction expenses is as follows:

Clearing the road bed	1000 workers	ea. 0.50piasters	500.00pi.
Engineering the road bed	3000m	ea. 3.00	9,000.00
Culverts	10 sites	ea. 150	1,500.00
Bridges	3 sites	ea. 500	1,500.00
6-ton rail	4 km	ea.4000	16,000.00
Reserve stock, related goods			3,000.00
Crossing materials	15	ea.250.00	3,750.00

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Ties	7000 7000 ea.0.10	700.00
Wages for railway construction	3.5km ea.500.00	1,750.00
Preparing wharf on Ngoi Lao R.		3,000.00
$\frac{1}{2}m^3$ ore cars	50 ea. 500.00	25,000.00
Related materials and reserves		5,000.00
Setting up a forge		5,000.00
Tools		1,000.00
	Sub-total	76,700.00

(3) Buildings

Explosives sheds	2 ea.2,500.00	5,000.00
Dormitory for Japanese staff	200 sq.yd.	5,000.00
Office	48 sq.yd.	1,200.00
Warehouse	160 sq.yd	3,000.00
Workers' residences	5 bldgs (160 sq.yd.)	10,000.00
Same	20 bldgs (80 sq.yd.)	7,500.00
Miscellaneous small buildings	20 bldgs (40 sq.yd.)	1,000.00
	Sub-total	32,700.00

(4) Management Expenses

Salaries of construction technicians	ea.400.00 x 6 mos.	2,400.00
Salaries of clerical staff	ea.300.00 x 6 mos. x 2 men	3,600.00
Native foremen	ea. 50.00 x 6 mos. x 5 "	1,500.00
Native clerks	ea. 50.00 x 6 mos. x 3 "	900.00
Office and company house	ea. 100.00 x 6 mos.	600.00
Communications, travel, misc.	ea. 300.00 x 6 mos.	1,800.00
Share of French Indo-China main office's expenses	ea. 2000.00 x 10 mos.	20,000.00
Freight charges about 300-ton	ea. 50.00	5,000.00
Furnishings and utensils		5,000.00
	Sub-total	50,800.00

(5) Facilities for Water Shipment

The boats used for shipping on the Ngoi Lao and Red Rivers would all be either chartered or requisitioned craft.

The total figure for construction expenses is 160,200.00 piasters. Against the previously noted amount of ore (converted by the safety factor) of 125,000 tons, this would come to 1.28 piasters per ton.

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(c) Required Construction Materials

Materials expected from Hapan are as follows:

6-ton rail	6 km	ea. 15 tons	Ordinary steel	90.00 tons
Related goods and reserves				15.00
Crossing materials			" "	5.00
Steel plate for ore bins			" "	3.00
20 ore cars			Ordinary steel	3.00
			(Pig iron	21,00
			Special steel	0.50
Hoists			Ordinary steel	1.00
			(Pig iron	1.00
Steel cable for above			Special steel	1.00
Tools, forge tools			Ordinary steel	0.50
			Special steel	0.50
Nails, bolts, nuts and clamps			Ordinary steel	3.00
Explosives			Minor amount	

Totals	(Ordinary steel	138.50 tons
	(Pig iron	8.00
	(Special steel	2.00
	(Explosives	minor amount

(d) Production Expenses

(1) Mining expenses

The mining by excavation of open-cut terraces would connect each terrace with an ore bin about 20 meters below, while the upper parts would be connected to the lower area by a simple hoist

Digging expenses	0.30 piasters
Earth-moving	0.10
Hauling	0.15
Coal carts	0.02
Tracks 2	0.05
"Hole winding" [?]	0.02
Explosives	0.05
Supervision	0.10
Miscellaneous	0.05
Sub-total	0.84 piasters

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(2) Transportation expenses

For the approximately 3 km from the minesite to the Ngoi Lao River, 0.6-meter gauge rails totalling 6 km would be installed. At midpoint a switch station would be set up; and on each line 25 ore cars would be used, for a total of 50 cars. A total of 150 car-trips daily would be accomplished by hand pushing. The ore rock is limonite, with a low specific gravity, so that no more than about 0.7 tons could be loaded into each $\frac{1}{2}m^3$ ore car. Thus, 150 car-trips would be able to haul 105 tons of ore.

Ore-car loading		0.10 piasters
Hauling		0.35
Unloading and storage		0.15
Supervision		0.03
Miscellaneous		0.02
	Sub-total	0.65 piasters

(3) Water transportation expenses

It would be necessary to transport the ore by water over the 270 km from the mine to Haiphong. In the 180 km between Haiphong and Vie Tri there are a number of shoals of only 1.8 meters depth during the dry season, or low-water season, so that it is not possible for lighters of even 100 tons burden to navigate; we were told that 70 to 80 ton lighters can make the trip. For the 90 km from Vie Tri to the mine a precise survey of the channels has not been possible, but probably 30 to 50 ton lighters could navigate the distance.

Lighter loading		0.15 piasters
Lighter hauling: mine to Vie Tri (90ton) [sic]		1.70
Trans-shipping at Vie Tri		0.20
Lighter hauling: Vie Tri-Haiphong(180-T) [sic]		2.30
Unloading at Haiphong		0.25
Loading onto lighters at Haiphong		0.20
Loading onto depot ship		0.50
Tugboat		0.50
Supervision, Miscellaneous		0.05
	Sub-total	5.85 piasters

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(4) Other expenses

Ore production tax	0.15 piasters
Export tax	0.50
On-the-spot management	0.50
Share of management expenses at French-Indo-China main office	1.00
Amortization and profit	1.40
Royalties	0.50
Sub-total	4.05

(5) Grand total - Production

Mining	0.84 piasters
Transportation	0.65
Water Transportation	5.85
Other	4.05
Total (F.O.B.)	11.39
Freight - Indo-China to Japan	12.00
GRAND TOTAL	23.39
Conversion for weight loss - 107.5%	25.05 piasters

The total cost of production ϕs 25.05 piasters; and when the profit of the controlling company (managed stock company) and the share of the home company are added to this, the cost in Japan would become 27.00 yen [sic], which would make it impossible to mine this kind of limonite at a pbofit under existing prices. The main reasons for the high costs are seen as:

(A) The great cost of defraying construction costs, and the small amount of ore,

(B) The small amount of extractable ore and the great cost of defraying management expenses and other indirect costs,

(C) The great distance for water transportation.

On the whole, the basic reason is the small amount of ore.

As for the great distance for water transportation, if special vessels, such as steam launches or diesel launches, were to be constructed, it would be possible to plan a reduction in ordinary expenses; but adding in the cost of this construction would give the same result, and there would be little choice between the two total costs.

12. Conclusions

The ore of this mine is limonite and goethite; its grade is Fe 48%: which is difficult to consider as good. If this mine were developed, the selling price for the ore on arrival in Japan would be 27.00 yen; and production would be about 30,000 tons annually for four years. But, the price given is quite far off from current prices for this kind of limonite ore, so that under existing conditions the profitable working of this mine would be impossible. Since the purpose of the development of this mine would be to supply the ore to foundries having furnaces that could handle limonite ore, the production of the ore would become possible only under the special policy explained in Chapter I, in the last article on taxes.

5. The Thack Khoan Mine
(Appended figures 11 and 12)

1. Name of Mine

Called the Thack Khoan mine.

2. Concession and Holder of Rights

The concession is a mining concession as follows:

Concession No.	Concession Name	Date Registered	Rightholder
Concession No.201	Thack Khoan	Sept. 24, 1938	Nguyen Huy Tran

The vicinity of the mine includes a mining concession and a prospecting concession, as shown in Figure 11.

3. Location and Communications

The mine extends between Thack Khoan and Giap Lai villages in Thanh Thuy County, Phu Tho Province, Tonkin State.

From Hanoi, the Rivier Noire shore (about 58 km from Hanoi) is reached via Son Tay (41 km from Hanoi) on the local railroad from Hanoi to Hung Hoa to Phu Tho. After ferrying across, one goes on to the southwest about 10.5 km on the road on the north shore of the Rivier Noire, reaching La Phu village. The mine is about 6 km northwest of this village, on the north side of Thack Khoan village. The road from Hanoi to the mine is generally level and in good condition - passable by auto. But, between La

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Phu and the mine there is some grade, so that part of the road surface is not good.

4. Present Condition of the Mine

This is an operating mine with a very close relationship with the Indo-China Industrial Company, Ltd. However, there are no Japanese employees or French staff. Mining, transporting and hauling are all carried on by the contract system, and the produce is handled by receipting. 200 laborers currently are engaged in mining, hauling and transporting. The mining is irregular, terraced open-cut mining. For hauling at the working faces there are no rails at all, and no coal carts or hoists - all work depending on human power.

The ore is taken to the banks of the Rivier Noire at La Phu over 4 km of land road and 4 km of marsh land. The loaded lighters are sent down to Haiphong. Hand carts and horse carts are used for transporting the ore on the 4 km of land road. Their sizes are recorded as:

0.80m x 0.38m x 1.55m = 0.470m^3 . . . . 0.940 tons capacity
0.64m x 0.40m x 1.32m = 0.338m^3 . . . . 0.676 " "
0.85m x 0.38m x 1.87m = 0.604m^3 . . . . 1.208 " "
0.80m x 0.40m x 1.55m = 0.490m^3 . . . . 0.980 " "

So, their size is 0.3 to 0.6 cubic meters, with a capacity of 0.6 to 1.2 tons, averaging 0.95 tons. As there are currently 40 carts, capable of two round trips a day, the hauling capacity per day is only 0.95T x 40 carts x 2 trips x 80% = 60.8 tons.

For hauling over the marshes, bamboo sampans of all sizes are used. The large ones are 4 to 4.5 meters long with a 1.0 to 1.5 meter beam and 0.3 to 0.45 meter draft, and a load capacity of 0.3 to 0.5 tons. The ore transported to the Rivier Noire shore is stored temporarily on the land and then loaded into the lighters when they come upstream. The Noire and Rouge (Red) Rivers between La Phu and Vie Tri can accommodate 100-ton burden lighters during the high water of the rainy season. But, in the dry season when the water is low, they have shoals in several places and can take lighters of no more than 25 to 30 tons burden, so that after trans-shipping at Vie Tri the ore is sent on to Haiphong. From La Phu to Vie Tri is a

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distance of about 30 km, and from Vie Tri to Haiphong, about 180 km - a total of 210 km. Next, looking at the production costs at this mine:

Mining and earth-moving	1.35 piasters
Hauling by ox- and horse-cart	1.20
Sampan shipping	0.90
Lighter shipping	2.50
Total	6.95 piasters [sic]

However, the above are only the actual production costs; related indirect costs must be added to them.

There has been the following publication concerning this mine:

"Data on the Mining Industry in French Indo-China", Ko-A Institute, 1940, pp. 228-232.

5. Terrain

The vicinity of the mine has been developed into paddy fields from the low, mound-like hills to the lowlands between the mounds. The ore deposit has a relative height of around 25 meters, a width of 200 to 300 meters, a strike of about N30°W, and it continues for about 3 km. It is located on a peninsula-like mound in the midst of the paddy fields, on the northeast slope. The area where the deposit occurs on this hillock has mostly been cleared, but other sectors are a matted jungle growth of trees and grasses.

6. Geology

The geology of the region of the ore deposit is Devonian period and alluvial strata. The Devonian strata is mostly granular white quartzite-type sandstone, with a small amount of quartz and mica included. In the area of the ore deposit the strike and the gradient are obscure, but in the exposed mica schist near the small marsh southwest of the deposit we measured a north-south strike and also one of N15°W, and a gradient of W25° and also 40°. In the same small marsh there are scattered rocks of amphibole (hornblende) diorite. And, on the west of the hill area where the ore deposit is there is a body of igneous rock.

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7. The Ore Deposit

The ore deposit is a so-called loose-rock deposit formed in the red-brown soil covering the slopes of the mound. The ore rock is chiefly limonite and is distributed in four distinct sections, as shown in Figure 12. These are called Deposits 1, 2, 3 and 4. In this deposit the areas of distribution of limonite are the depression between No. 1 and 2 deposits, the edge of No. 4 deposit, the area near to the No. 6 and 7 prospecting pits and the area near to Thack Khoan village (outside of Figure 12). But, these contain large amounts of sandstone fragments along with the ore in a haphazard distribution and have no value as ore deposits.

The ore occurs near the surface of the top soil and lies 2 to 5 meters thick, often covered by less than one meter of ore-free topsoil.

The size of the ore boulders usually ranges from less than the size of a human head to bean size - mixed together in all proportions. In special cases there are somewhat vein-like deposits of ore rock. The percentage of ore content varies markedly from location to location, but on the whole there is 0.2 to 0.6 tons per cubic meter. And, in the ore deposit there is not a little sandstone gravel mixed in, besides the ore.

(a) No. 1 Ore Deposit

The largest amount of ore left in this deposit occurs here, and it has the highest density of deposition, and thus the least variation. The grade of the ore in this deposit, too, is the best. This can be the nucleus for working the deposit in the future.

(b) No. 2 Ore Deposit

Most of this deposit has been worked out, so that little ore remains. Except for the north end of the ore deposit, the ore is admixed with a large amount of matrix fragments so that it is low grade. In the part already worked, also, there is but a small amount of ore remaining, and much excavated earth has been dumped onto it so that remining this section would probably be most difficult.

(c) No. 3 Ore Deposit

Previously, this was a continuation of No. 2 Deposit's ore body, but it has been separated by mining. The thickness of the deposit is considerable and the boulders contained herein are fairly large; but the conditions of deposition produce a rather rough scattering. At present, this is the center of the mining, together with the northern end of the No. 2 deposit; but already half of the deposit has been mined: it is past its peak. From now on, the percentage of ore content will be decreasing.

(d) No. 4 Ore Deposit

Not only is the area of distribution of this deposit small, but also the mixture of many other rocks along with the ore means that the grade is not good..

Next, the conditions of the mining face and of the prospecting pits will be dealt with. However, as the prospecting pits already dug had as their main purpose the discovery of new ore bodies, their location and the conditions of ore deposition already learned from them are not particularly pertinent to the survey.

Condition of Ore Deposits at Working-Face Cuts:

Location	Height of Cut	Ore Content in soil (vol.)	Am't of ore/m^3	Notes
SW end of No.1 Deposit	1.2 meters	1/3	0.7 tons	Doesn't reach to bottom of deposit.
NW end of No.1 Deposit	1.2	1/5	0.4	Same.
Cliff, center of remaining part of No.2 Deposit	3.5	1/6	0.3	Mostly low-grade boulders.
South part of No. 3 Deposit	3.5	1/5	0.4	-
Same, north part	4.5	1/10	0.2	Little ore.
No. 4 Deposit, center of cut	2.0	1/5	0.4	Low-grade ore.

(Specific gravity of the ore is 2.0.)

Condition of Ore Deposits in Already Established Prospecting Pits

No. of Pit	Depth	Vol. of Earth Excavated	Am't of Ore Extracted	Am't of Ore/m^3	Related Deposit	Condition of Deposit
1	3.2m	4.1m^3	2.8T	0.7T	No.1Dep.	Many ore boulders under size of human head.
2	2.2	2.8	2.6	0.9	Same	Same.
3	2.1	-	-	-		Limonite with white sandstone.
4	2.5	-	-	-		Only white sandstone, no ore
5	2.0	-	-	-		Same.

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6	2.5	-	-	-		For 1 meter in center of cut there is a small am't of ore, but sandstone content makes grade very poor.
7	2.6	-	-	-		Small am't of ore, with many other rocks admixed.
8	2.3	-	-	-		Only white sandstone, no ore.
9	3.6	-	-	-		Small am't of ore in red-brown soil.
10-15	-	-	-	-		White sandstone only, no ore.
16	3.0	-	-	-	No.4 Dep.	Bean-size ore rock; admixture of sandstone gives poor grade.
17	1.5	-	-	-	Same	Some ore; no value as an ore deposit.
18	1.6	-	-	0.5	Same	Rather low grade ore.
19	-	-	-	-	Same	Sandstone admixture, so poor grade of ore.
Simple Prospecting Pits Excavated by this Survey						
A	1.5	3.4	1.7	0.5	No.1 Dep.	In center of pit; already dug to 1 m.
B	0.7	-	-	-	Same	Only small am't ore.

8. The Ore

The ore is limonite, rarely with an admixture of goethite. It is very porous and nodular, with a pitted and nobby surface, causing the soil to adhere. Not only does the ore contain portions of sandstone, but also there are fragments of sandstone admixed with the ore boulders so that the grade is not good. The ore of Nos. 1 and 3 Deposits is of passable quality, but that of Nos. 2 and 4 Deposits is bad. The ore contains some manganese. Also, there is some pyrite, but in small amounts. The assay figures for the ore as as follows:

Serial No.	Deposit	C.W.	Fe	Mn	SiO_2	P	S	CaO	Al_2O_3	MgO	TiO_2
34	Thaok Kkban Iron mine	9.60	56.40	0.27	3.16	0.109	0.102	0.44	2.32	0.20	0.76
35	〃	12.32	46.40	0.27	6.73	0.089	0.315	0.33	5.46	0.34	1.12
36	〃	10.96	54.76	1.27	3.18	0.098	0.124	0.80	2.36	0.17	0.21
37	〃	10.74	55.92	0.74	2.54	0.088	0.113	0.42	2.56	0.16	trace
38	〃	11.94	54.21	0.80	2.47	0.101	0.111	0.30	3.24	0.20	0.18
39	〃	11.96	54.46	0.58	2.46	0.137	0.117	0.53	2.42	0.14	trace

(Assay by Hachiman Foundry, 1942)

9. Origin of the Ore Deposit

In this deposit there is a small amount of pyrite. And, in special cases the surfaces of the ore boulders are only limonite, while towards the center the amount of pyrite gradually increases. Also, near the ore deposit there is loose white sandstone, with a small amount of pyrite permeating it. Probably, then, the limonite ore deposit originally metasomatosed with the white sandstone, intruding into it, with the iron-sulfide ore deposit being the origin of the deposit. Through the breaking up of such a deposit, the loose ore rocks were formed; and by the characteristically strong oxidizing effect near the surface in the tropics the limonite was later formed from the pyrite. Also, while no igneous outcroppings may be seen near the ore deposit, in the mountainous area to the southwest the existence of diorite is to be expected; for at a road cut about 1 km south of the mine on the way to La Phu there is a vein of pegmatite. The pyrite ore mist have some relationship to these igneous movements.

Near the boundaries of No. 2 and No. 3 Deposits there are several limonite boulders with a diameter of around 3 meters. These large stones lie roughly on a strike of N30°W. Their lower part is buried in the earth so that the details on that part are unknown; but probably they have so-called roots. They look like oxidized outcroppings of iron-sulfide ore deposits. And, it might be said that from the origin of the deposits, such ore bodies could have extensive underground continuations.

10. The Amount of Ore

Based on the data from the mining faces and the prospecting pits recorded in the paragraph on the ore deposit, and from a consideration of the facts learned from the surface survey we fixed the basis for the computation of the amount of ore. In this case we are considering ore naturally dried so that the specific gravity is 2.0. And, as the prospecting of the ore deposit has been inadequate, the assumed amount of ore in each case is a deduced amount.

(a) No. 1 Deposit

(1) Still unmined part

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Area	$14,831m^2$
Average Depth	3.0 meters
Avg Ore Content/m^3	0.6 tons
Estimated Amount of Ore	26,696 tons

(2) Partly mined part

In the part of the deposit already mined there is still some ore remaining in the lower part; it is possible to re-mine it.

Area	$2,165m^2$
Average Depth	1.5 meters
Avg Ore Content/m^3	0.6 tons
Est. Amount of Ore	1,948 tons

Total for No. 1 Deposit: 28,644 tons

(b) No. 2 Deposit

In the already mined part there is a slight amount of ore, but it would be difficult to re-mine; only the unmined part is estimated.

Area	$6,438m^2$
Average Depth	3.0 meters
Avg Ore Content/m^3 (excluding low-grade ore)	0.2 tons
Est. Amount of Ore	3,863 tons

(c) No. 3 Deposit

There is no ore remaining in the already mined part.

Area of unmined part	$4,969m^2$
Average Depth	4.0 meters
Avg Ore Content/m^3	0.3 tons
Est. Amount of Ore	5,963 tons

(d) No. 4 Deposit

Area	$1,531m^2$
Average Depth	2.0 meters
Avg. Ore Content/m^3 (excluding low-grade ore)	0.3 tons
Est. Amount of Ore	919 tons

Total for Deposit	No. 1 Deposit	28,644
	No. 2 Deposit	3,863
	No. 3 Deposit	5,963
	No. 4 Deposit	919
	TOTAL	39,389 tons

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In storage at the mine at the time of the survey were the following amounts:

Near No. 1 Deposit	400 tons (approx.)
Near No. 2 & 3 Deposits	1,200 tons
Near No. 4 Deposit	50 tons
Total	1,650 tons

11. The Development of the Mine

This mine is currently being worked. As for the working conditions, the main points have been mentioned in the paragraph on existing conditions at the mine, so that in this paragraph we will consider plans for extracting a maximum amount of ore and increasing production.

(a) Mining

The present mining is very non-uniform and unplanned; thus mining efficiency is low and a large amount of ore is being lost. By all means planned mining must be carried out, and thereby planned terracing for establishing the conditions of ore deposition must be practiced. However, the mining site itself is believed to have certain limitations making it difficult to exceed a daily production of 100 to 150 tons. And, at present ore rocks under the size of apricots are being thrown out along with the excavated ore, but this could be recovered by sorting and water dressing. Still, not only should this be profitable, but it should also be done from the standpoint of resources conservation - points that require careful study.

(b) Transportation

The use of primitive transportation methods, such as hauling by oxcart and horse cart and shipping by bamboo "sampans", not only means a low ore production, but also is probably the reason for the unsettled perilous state of the active investments of Japanese firms under the French Indo-Chinese mining laws and company regulations with respect to multi-party firms. In consideration of the production expenses, it is not impossible that by planning the reform and improvement of these methods an efficient operation could be set up. As for the oxcart and horse-cart transportation, it would be possible to increase their transporting efficiency by increasing the number of vehicles. However, as for "Sampan" shipping, the narrowness of the channels on the Rivier Noire and the difficulty of deepening the channels

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would not permit exchanging the sampans for anything else, and it would not be possible to increase the amount of ore produced simply by increasing the number of these craft. Thus, the maximum limits are reached here. We heard that the operations foreman is planning very soon to (1) replace the bamboo sampans with wooden ones and (2) set up 1.5 km of track from the bank of the Rivier Noire. Judging from the amount of remaining ore, these are the recourses possible.

12. Conclusions

This mine is a working mine with a very close connection with the Indo-China Industrial Company, Ltd. However, the present mining is exceedingly irregular, and land transportation is extremely primitive. these factors together going a long way toward preventing any increase in the production of ore.

As for rapidly increasing the production of this mine, first of all policies are needed that will verify the conditions of ore deposition; and then it is necessary that planned mining be practiced and transporting efficiency be increased. To this end, the increase in oxcarts and horse-carts and the currently planned substitution of wooden "sampans" for the bamboo ones, as well as the laying of a section of track, are urgently needed reforms. At the same time, it would be difficult to supply to Japan as much as 30,000 tons annually from this mine's daily production of about 100 tons of Fe 54% limonite ore.

6. The Tang Ma Mine
(Appended figures 11 and 13)

1. Mine Name

Called the Tang Ma mine.

2. Concession and Holder of Mining Rights

The ore deposit lies in the following prospecting area:

Prospecting Area Number	Prospecting Area Name	Date Registered	Holder of Prospecting Rights
Hanoi 207	Espoir	October 20, 1934	Nguyen Hun Lar

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However, on October 10, 1937, an application was filed under No. 183 to make this prospecting area a mining concession. Near to the mine, as shown in Figure 11, are many prospecting areas, such as Thank Khoan.

3. Location and Communications

The mine is in Tang Ma village, Than-Thuy County, Phu Tho Province, Tonkin State, abiut 3.5 km from the west bank of the Rivier Noire and 4 km northeast of the Thack Khoan mine.

To reach this mine from the Hanoi area the same route is followed as with the Thack Khoan mine, going about 3.5 km northwest from La Phu. The road is passable to autos the whole distance, but we were told that near to the mine a part of the road becomes mired in the rainy season.

4. Present Condition of the Mine

The produce of this mine is sold by the Indo-China Industrial Co., Ltd. Formerly, the ore was transported by truck from the mine to the Rivier Noire and then shipped via the Rivers Noire and Rouge to Haiphong. More than half of the ore has already been mined out; at present 230 workers are continuing a very small-scale operation. The daily production is no more than 5 to 10 tons.

There have been the following publications relating to this mine:

"Data on French Indo-Chinese Mining", Ko-A Institute, 1940, pp.225-227.

Horikoshi, Giichi, "The Tang Ma Mine", <u>Survey Reports of French Indo-Chinese Mines and Ore Deposits</u> (Taiwan Development Company, Ltd., publisher)

5. Terrain and Geology

The neighborhood of the mine constitutes an aged, hilly terrain. The ore deposit occurs at a relative altitude of 85 meters, on the south slope of a roughly conical hill. The vicinity of the deposit consists of grassy hills with mixed grasses of scarcely hip height, and almost no trees. The evidences of past mining of the deposit cover a broad range of the slope, being evident in the exposed red-brown soil of the mounatin flank.

The hill where the ore deposit occurs contains mica schist related to the Red River shore crystalline schist system, and quartzite schist. At the southeast foot white, coarse-grained, somewhat gneiss-like mica and granite outcroppings are exposed. In the schist grouping and especially in the part adjacent to the granite bodies there are many veins of aplite, pegmatite and quartzite. The strike and gradient of the schist varies greatly according to the location. On the south slope of the hill the strike is both east to west and northeast to southwest. A fault running approximately east and west can be assumed to occur in between.

6. The Ore Deposit and the Ore Rock

In the ore deposit there are both a contact ore deposit and a loose-rock deposit formed from this. The ore is hematite and magnetite; and most of the magnetite part has fairly strong magnetic qualities. Most of the hematite must be classified as mag-hematite and martite.

Also, the ore is vein ore containing some white radial minerals believed to be quartz, mica and probably sillimanite.

(a) The Contact Ore Deposit

This kind of ore deposit is of comparatively recent discovery; it crops out at three different places, named the Number 1, 2 and 3 Deposits. Mica schist is the matrix rock, and the ore bodies occur in shapes from almond form to veins - in the crevices. Always the scale is small, extending for some 10 to 30 meters. The width is a maximum of 2 meters. Also, the ore in this kind of deposit particularly contains a large admixture of gangue and matrix rock. Having irregular black and white bands, with quartz in seams or spots and a large alumina content, the ore is very low grade. To raise the grade, a considerable amount of sorting would be necessary after mining, so that most of it actually is not worth working.

(b) The Loose-rock Ore Deposit

This kind of deposit, as stated above, derives from the contact deposit and occurs in several separate places. It forms the main source of supply from this mine, but most of it has already been extracted. Though a small amount still remains, it would be difficult to manage without using explosives, this especially being true of the many large ore boulders. The boulders are from calf size down to fist size. There are no ore layers in the topsoil, the ore simply being scattered on the surface of the ground. Since the mining in the past has been exceedingly haphazard, there is still some ore remaining below the excavated tailings - these presently being re-worked on a small scale. The ore rock occurring in this kind of deposit is very hard and fine grain, with only small amounts of admixed matrix and gangue, so that the grade is very good.

The assay values for the ore are as follows:

SERIAL NO.	MINE OR DEPOSIT	C.W.	FE	MN	SIO_2	P	S	CAO	AL_2O_3	MGO	TO_2
31	TANG MA IRON MINE	1.70	65.80	1.03	1.34	0.020	0.031	0.50	1.18	0.17	0.44
32	"	2.06	64.60	0.38	2.96	0.015	0.037	0.60	1.29	0.21	0.32
33	"	1.38	64.00	0.91	4.36	0.015	0.055	0.56	1.00	0.34	0.34

(Assay by the Hachiman Foundry, 1942)

7. Amount of Ore

We consider the rock with over 50% Fe as ore rock and compute the amount of ore accordingly. The specific gravity of the ore is 4.0.

(a) Contact OreeDeposits

(1) No. 1 Deposit

Exposed part - occurs in the form of a triangle with a 21-meter base and a height of 5 meters; the average width is 1 meter. 21 X 5 X 1 X $\frac{1}{2}$ = $52m^3$

Estimated underground part - we consider that the extension undergpound is half as much, or 10 meters. 21 x 10 x 1 - $210m^3$ [sic]

In these, the Fe is over 50%.

Amount of ore: (52 plus 210) x 0.5 x 4.0 = 524 tons - or, 520 tons

(2) No. 2 Deposit

No more than about 20% of the ore in this deposit can be assumed to have over 50% Fe, so that it is not worth working; and consequently we have not computed the amount of ore.

(3) No. 3 Deposit

This deposit is about 1 meter wide and 30 meters long. There are estimated to be some 500 tons of ore over 50% Fe, but this is no more than 30% of the whole ore body. Since it would be difficult to work more than the exposed part, we do not compute the amount of ore in this deposit.

(b) Loose-rock Ore Deposits

(1) The Unmined Part

Area of A section	$6,531m^2$	9,875 square meters total
Area of B section	$3,344m^2$	
Average ore content/$100m^2$		20 tons
Amount of ore:		1,975 tons, or 1,970 tons

(2) The part already mined

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Serial No.	Mine or Deposit	O.W.	Fe	Mn	SiO_2	P	S	CaO	Al_2O_3	MgO	TiO_2
31	Tang Ma iron mine	1.70	65.80	1.03	1.34	0.020	0.031	0.60	1.18	0.17	0.44
32	"	2.06	64.60	0.38	2.96	0.015	0.037	0.60	1.29	0.21	0.32
33	"	1.38	64.00	0.91	4.36	0.015	0.055	0.56	1.00	0.34	0.34

(A) Large boulders remaining because of being difficult to mine:

In C section		600 tons
In D section		70
	Total	670 tons

(B) Ore remaining under tailings in part already mined: Not possible to compute; however, it would be less than 100 tons at most. Not computed into the amount of ore.

The ore which should be the object of future mining operations is that existing in appreciable amounts; totalling this, we get the insignificant figure of 3,160 tons.

8. Conclusions

For the most part, the mining of the loose-rock deposits of this mine has been completed. Fairly recently the contact-ore deposit, which should be called the main body of the deposit, has been seized upon. But, not only is it small scale, but also the grade is poor. There would be almost no profit to rejuvenating it. Thus, this mine has already entered into its period of decline, with the total remaining ore being about 3,000 tons - more than half of this presenting the difficulty of requiring explosives in order to work it. Thus, under the present conditions of neglect, no more than 1,000 to 1,500 tons of ore can be extracted hereafter. It will be necessary to give attention to the supplying of explosives and working the large ore bodies.

7. The Sangvan Ore Deposit

1. Location and Mining Concession

This deposit is at Giap Lai village, Thanh Thuy County, Phu Tho Province, Tonkin State. It is about 3 km northwest of the Thack Khoan mine.

The concession is a prospecting area, as follows:

Prospecting Area No.	Prospecting Area Name	Date Registered	Holder of Prospecting Rights
Hanoi 3352	Sangvan	Apr. 2, 1941	Do Long Giang

As no name has yet been given to this ore deposit, we have temporarily applied the name of the prospecting area.

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2. Geology and the Ore Deposit

The area around the ore deposit is hilly, just like at the Thack Khoan mine. The hill where the deposit is located rises some 60 meters above the surrounding paddies and extends SSE for about 500 meters. The geology of the hill is sandstone, with a strike of N10° - 20°W and a gradient of 20°- 30° to the west. The ore deposit is made up of loose, hard and fine-grain hematite stones at the southwest foot of this hill. The grade of the ore is very good, probably over Fe 60%. The loose rock consists of just three large boulders and some smaller ones. The computation of the amount of ore is as follows:

(1) 4T (wt./m^3 ore rock) x 2.5 x 2.5 x 3.5 x 2/3 (factor for the shape of the rock) x 1.5 (est. am't underground) = 88 tons.

(2) 4T (") x 1.5 x 2.5 x 2.5 x 2/3 (") x 1.5(") = 38 tons.

(3) 4T (") x 0.4 x 1.5 x 1.5 x 2/3 (") x 1.5 (") = 4 tons

(4) 2 to 3 smaller loose rocks and estimate of those below the surface: 50 tons

Total 180 tons

3. Conclusions

We can only say that there is ore in this deposit, but with no industrial value whatsoever.

8. The Tuyen Quang Mine

(Appended Figs. 15, 16 and 17)

1. Name of Mine

Using the name of the prospecting area, it is Ngoi Lee; but it has previously been called Tuyen Quang iron mine by a Japanese.

2. Concessions and Holders of Mining Rights

The concessions of this area are as given below. All are prospecting concessions, except that No. 1110 is a mining concession - under application. The iron ore deposit surveyed this time is in these same prospecting areas.

Prospecting Area Number	Prospecting Area Name	Date Registered	Holders of Prospecting Rights
Tuyen Quang 1110	Ngoi Lee	Feb.27,1937	Nguyen Van Can
" " 1225	Thiet Thans	Feb.23,1940	"
" " 1226	Thiet Thuc	Same	"
" " 1227	Thi Thiet	Same	"
" " 1240	Thuc Ninh	Apr.18,1940	"
" " 1241	Tho Soh	Same	"
" " 1262	Bac Thinh	Sep.4,1940	Hoan Hun Hau

3. Location and Communications

The mine is at Tho Son village, Hamyen County, Tuyen Quang Province, Tonkin State. It is located some 15 km NNW of Tuyen Quang city, capital of this region. It is in a mountainous region of limestone between the main channel of the Rivier Claire and its tributary,Son Gam.

The route from the Hanoi area to the mine is as follows: First one goes to Tuyen Quang city (163 km from Hanoi) via the Route No. 2 Coloniale, and then turns north for 21 km to the small village of Ninh Gi (100,000:1 map shows Vinh Gi). From here one goes along the village road through Lang That village and on eastward about 3.5 km, coming out on the bank of the R. Claire. The river is ferried by a small vessel; and then one goes further to the east barely 2.5 km to reach the site of the ore deposit. Route No. 2 Coloniale is a fine road running most of the distance between Hanoi and Ninh Gi. The village road from Ninh Gi, across the R. Claire to the iron ore deposit, passes through hilly land; but the grades generally are not steep. However, the width is around 1 meter and the surface is not good, so that it can only be walked. In the rainy season this road is a mire, and even walking is a real hardship.

For transporting the ore, the R. Claire would be convenient.

4. History and Present Condition

This mine is undeveloped, with operations completely idle at present. Several years ago considerable prospecting and some plans for development were carried on; and even now there exist many prospecting pits and two excavation sites near the deposit, with several scores of tons of ore in storage. There are remnants of railway construction up to half the way

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from the Rivier Claire; and there is a building still on the banks of the river which could serve as an office.

There has been the following publication relating to this ore deposit: "Data on the French Indo-China Mining Industry, Ko-A Institute, 1940, p.232.

5. Terrain

The vicinity of the ore deposit consists of groups of steep limestone peaks with gently rolling vallies in between. The hilly limestone region has very steep slopes that rise quite abruptly from the surrounding flatland. In part, then, it is a development of young karst terrain. Both the flatland and the hilly land are covered by flourishing broad-leaf trees, bamboo and high reeds and grasses - so-called "jungle", which is rather difficult to penetrate. From the minesite to the Rivier Claire it is almost all flatland, with no major slopes.

6. Geology

The geology of this region belongs to strata called "Complex de la Riviere Claire" on the 500,000:1 Cao Bang sector map. Within the scope of the area surveyed, most of the outcroppings in the vicinity of the ore deposit are limestone. The limestone always has a pale gray or white color, is fine grain and crystalline. There are but a few places where the strike can be measured. To the west of the ore deposit about 2 km, the strike in the outcropping limestone is N70°W, and the gradient is NE70°; but the geological structure near to the ore deposit is unclear. In the flatland between the steep limestone peaks there are occasional limestone outcroppings, but in general it is a topsoil alluvium of terra rossa humus and rock fragments, covering the geological structure so that it is difficult to determine. Occasionally, there are rocks of mica schist, sandstone and quartz mixed into such topsoil, so that there should be part of this kind of rock together with the limestone. But, no outcroppings of these rocks are to be seen.

7. The Ore Deposit

The ore deposit is a deposit of loose rock, occurring on the flatland between the limestone peaks. The ore is a mixture of hematite and magnetite. The ore rocks range in size from ox or horse siz to bean size. Often a

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single boulder will run to several tens of tons. These are exposed above the topsoil or sunk into the red-brown earth. In the main part of the deposit, besides the ore boulders there are fragments of other rocks mixed in, but in small amounts - which is convenient from the standpoint of mining. The ore deposit is divided into the following three sections:

(a) A Deposit

This deposit has the widest area and the most dense deposition of ore: it is the main ore body of this mine. In the eastern sector of the ore deposit the ore is simply scattered loose on the ground, but from the center westward the ore is deposited in the topsoil to a depth of around 3 meters.

(b) B Deposit

While the area of distribution of this deposit is broad, the ore is found only on the surface of the ground, with almost none in the topsoil. It has a low density of ore distribution, and the western half is especially roughly scattered.

(c) C Deposit

In this ore deposit the ore rocks are not only on the surface of the ground, but also deposited to a depth of around 2 meters in the topsoil. The density of deposition is not great, and the area of the deposit is narrow. In one part of the ore deposit, the deposit is covered by 1 to 2 meters of ore-free topsoil.

Next, we will record the condition of the ore deposit as observed at representative points, prospecting pits and prospecting ditches.

Location	Surface of Ground and Prospecting Ditches Ore Deposition Conditions	Ore Content (T)	Related Deposit
Ditch #1, East half of Deposit	Highest density of ore deposition in the mine, with a number of ore boulders individually reaching some 40 tons.	$2.5T/m^3$	A Deposit
Ditch #2, West half of Deposit	Many ore boulders of several tens of tons tons scattered near ditch; large amount of smaller rocks in cut of ditch.	1.0	"
Vicinity of A	Accumulation of large & small ore boulders.	2.0	"
Vicinity of B	Many ore rocks scattered about.	1.0	"
Vicinity of C	Many ore stones less than puppy size.	1.5	"

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Vicinity of D	Many ore boulders of 10 tons and less scattered on ground.	1.5	B Deposit
Vicinity of E	Many ore stones less than puppy size scattered on ground.	0.3	"
Vicinity of F	Same.	0.5	"
Vicinity of G	Same as D above.	0.5	C Deposit

Prospecting Pits

Pit No.	Depth	Ore Deposition Conditions	Ore Content	Related Deposit
1	2.0 m.	No ore except some in top 1 meter.	Almost nil	B Deposit
2	4.0	Only small amount of ore in top one meter.	$0.1T/m^3$	"
3	5.5	No ore.	None	"
4	2.0	Only small amount of ore near bottom.	0.1	"
5-7	-	Almost no ore.	Almost nil	"
8	5.0	Limestone outcropping; no ore.	None	"
9	3.5	About 20% of ore consists of rocks of head size or smaller.	0.8	A Deposit
10	1.5	Only small amount of ore occurring with limestone.	Almost nil	"
11	2.6	Some ore only in bottom part.	"	"
12	5.5	No ore.	None	"
13	3.5	No ore.	"	"
14	2.5	Ore is under one meter of ore-free soil.	0.8	C Deposit
15	4.0	Ore is under 2 meters of ore-free topsoil.	0.2	"

8. The Ore

The ore is a mixture of hematite and magnetite - hard and rather fine grain - an exceedingly fine grade of iron ore. There is no fixed ratio of magnetite to hematite, there being samples in which hematite and magnetite each predominate. The hematite is a form of specular iron ore. It has a many-layered schistoid form and thin sheets of crystals. These crystals often are collected in radial forms. The ore that is mostly specular iron ore (glance iron) is somewhat porous. The weathered surfaces of the ore boulders sometimes are covered by a secondary limonite crust. And, in rare cases there is gangue quartz in the ore - in small amounts. As explained later, iron sulfide ore deposits occur separately, and we did not

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Serial No.	Mine or Deposit	O.W.	Fe	Mn	SiO_2	P	S	CaO	Al_2O_3	MgO	TiO_2
24	Tuyen Quang iron mine	4.26	66.10	0.30	1.35	0.019	0.057	trace	trace	0.48	trace
25	"	7.17	61.70	0.21	3.12	0.010	0.094	0.38	0.21	0.49	"
26	"	4.24	64.60	0.44	2.22	0.019	0.052	0.72	0.32	0.86	"
27	"	2.78	66.20	0.50	1.90	0.029	0.047	0.24	0.19	0.98	0.07
28	"	5.67	64.10	0.74	1.35	0.019	0.082	trace	0.25	0.93	trace
29	"	5.16	66.00	0.24	2.18	0.010	0.027	0.32	0.11	0.15	"
30	"	4.44	65.60	0.79	0.76	0.015	0.056	0.32	0.30	0.14	0.06

find any pyrite content in the iron ore, The assay figures for the ore are as follows:

SERIAL NO.	MINE OR DEPOSIT	C.W.	FE	MN	SIO_2	P	S	CAO	AL_2O_3	MGO	TIO_2
24	TUYEN QUANG IRON MINE	4.26	66.10	0.30	1.35	0.019	0.057	TRACE	TRACE	0.48	TRACE
25	"	7.17	61.70	0.21	3.12	0.010	0.094	0.38	0.21	0.49	"
26	"	4.24	64.60	0.44	2.22	0.019	0.052	0.72	0.32	0.85	"
27	"	2.78	66.20	0.50	1.90	0.029	0.047	0.24	0.19	0.98	0.07
28	"	5.67	64.10	0.74	1.35	0.019	0.082	TRACE	0.25	0.93	TRACE
29	"	5.16	66.00	0.24	2.18	0.010	0.027	0.32	0.11	0.15	"
30	"	4.44	65.60	0.79	0.76	0.015	0.056	0.32	0.30	0.14	0.06

(Assay by Hachiman Foundry, 1942)

9. Origin of the Ore Deposit

In this ore deposit, besides the ore deposits already noted, there are some in the valley to the south of A Deposit and in the eastern end of the No. 2 prospecting ditch. In these there is fine-grain ore composed chiefly of pyrite, with an admixture of some magnetite. These iron sulfide ore deposits are a metasomatose ore deposit formed in limestone. In the cross section at the end of the trench this ore crops out almost vertically, measuring 1.5 meters wide by 2 meters high. From the condition of such an outcropping we can establish the fact that the ore deposits extend underground. But, as the vegetation and topsoil effectively cover it over, the horizontal extension of the ore bodies are unknown. The limestone matrix of these ore deposits is crystalline, just as in the other parts. Those parts in direct contact with the ore deposits are not particularly changed in any way. On reflection, speaking of the iron ore deposits of this mine, the original ore deposit that supplied the loose ore cannot be defined. However, it must have been of great size, and it has now almost completely disappeared because of erosion and fragmentation. Consequently, assuming the existence of some relationship between the origin of the deposit and the properties of the loose ore, as well as the condition of the above-noted deposit of sulfidized iron ore, this is probably a metasomatose ore deposit from limestone. And, though no igneous rock has been discovered near the ore deposit, the deposit must be connected with past magmatic movements.

10. Amount of Ore

As for the amount of ore, only the loose ore is dealt with.

(a) A Deposit

From the deposition conditions we divide this ore deposit into two sectors to compute the amount of ore. Sector 1 -- west of the center the ore is found not only on the surface but is also mixed into the topsoil.

Area	16,500m^2
Average depth of ore-bearing topsoil (from Pit 9 and Trench 1)	3.0m
Average ore content of soil/m^3 (from data of Pit 9, Trenches 1 & 2 near A, B and C)	1.5 tons
Amount of Ore	74,250 tons

Sector 2 -- eastern part; ore is found only on the surface of the ground.

Area	5,250m^2
Average ore content/m^2	0.3 tons
Amount of ore	1,575 tons
Amount of Ore in A Deposit	75,825 tons

(b) B Deposit

The ore is only on the surface of the ground. The deposit is divided into three sectors on the basis of differences in the ore deposition conditions, and then computed as to the amount of ore.

Sector 1 Irregular range of ore deposition density; eastern half of deposit.

Area	8,500m^2
Average ore content/m^2 (from surface near Pits 2 and 4)	0.1 tons
Amount of ore	850 tons

Sector 2 The center of the deposit; rather high density of ore deposition.

Area	7,750m^2
Average ore content/m^2 (from conditions in D, E and F)	0.8 tons
Amount of ore	6,200 tons

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Sector 3 Occupying east part of deposit; ore occurs loose in long, narrow valley bottom among limestone rocks.

Length of part of valley containing ore	125 meters
Average width of same.	5 meters
Average ore content/m^2	0.3 tons
Amount of ore	187 tons
Amount of ore in B Deposit	7,237 tons

(c) C Deposit

The ore not only is on the surface, but also is mixed into the topsoil.

Area	5,250m^2
Average depth of ore in topsoil (from Pits 14 and 15)	2.0 meters
Average ore content/m^3 (from Pits 14 and 15 and from G)	0.5 tons
Amount of Ore	5,250 tons

Totals for the mine:	A Deposit	75,825 tons
	B Deposit	7,237
	C Deposit	5,250
	Total	88,312 tons

About 85% of the total occurs in the A Deposit.

11. Development of the Mine

This mine, containing somewhat less than 100,000 tons of ore, is not too attractive from the standpoint of the amount of ore it contains; but it has these strong points:

(1) The ore is a mixture of magnetite and hematite and can produce fine ore of around Fe 65%.

(2) The terrain between the mine and the banks of the Riviere Claire is generally flat, and thus land transportation over the intervening 2.5 km would be relatively easy.

(3) The ore is deposited chiefly in A Deposit, which has a low, flat terrain, and there is not much admixture of matrix rock fragments, so that the mining and the dumping of excavated earth would be simple and convenient.

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Despite its having such strong points, we are faced with high expenses because of the great distance for transporting the ore by water, down the Riviere Claire and Red River. Consequently, this mine does not warrant development.

(a) Mining, Dumping the excavated earth, Transportation Facilities

As the amount of ore is small, the facilities for development of course would be held to a minimum; and the materials for developing this mine would not be intended for use at this mine alone, but would necessarily be planned for subsequent use in other mines. And, we would consider plans based on a daily production of 100 tons - an annual production of 30,000 tons - which would exhaust the mine in three years' time.

(1) Mining

	number	unit cost	item cost
Clearing and burning the jungle	100 hectares	50.00 pi.	5,000.00 pi.
Mining and excavating the working face	2000 [unit?]	0.50	1,000.00
B Deposit hauling road	1000 meters	0.20	200.00
Ore bins	4	500.00	2,000.00
Hand carts	50	50.00	2,500.00
Tools	-	-	2,000.00
Explosives	-	-	5,000.00
		Sub-total	17,700.00

(2) Transportation

Clearing of roadways	500 [unit?]	0.50	250.00
Roadway earthworks	2500 meters	1.00	2,500.00
Culverts	5 sites	100.00	500.00
Bridges	2 sites	500.00	1,000.00
6-ton rail	3 km	4,000.00	12,000.00
Same: related materials and reserves	-	-	2,000.00
Crossings	15	250.00	3,750.00
Railroad ties	6,000	0.10	600.00
Rail installation	-	-	1,000.00
Tools	-	-	1,000.00
R. Claire wharf	-	-	2,500.00

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$\frac{1}{2}m^3$ ore cars	30	500.00	15,000.00
Same: related materials and reserves	-	-	3,000.00
Forge facility	-	-	5,000.00
		Sub-total	50,000.00

(3) Buildings

Office	1 - 108 sq.yd.		1,200.00
Staff dormitory	1 - 450 sq.yd.		5,000.00
Warehouses	2 -180 sq. yd. each		3,000.00
Explosives sheds	2		5,000.00
Workers' quarters	5 - 360 sq.yd.each		10,000.00
Same	5 - 360 sq.yd ea		7,500.00
Miscellaneous small buildings	2 = 90 sq.yd. each		1,000.00
		Sub-total	32,700.00

(4) Management

Construction technicians salary	400.00 x 6 mos. =		2,400.00
Construction clerks' salary	300.00 x 6 mos. x 2 =		3,600.00
Native foremen	50.00 x 6 mos. x 5		1,500.00
Native clerks	50.00 x 6 mos. x 3		900.00
Office and buildings	100.00 x 6 mos.		600.00
Communications, Travel, Miscellany	300.00 x 6 mos.		1,800.00
Share of expenses of French Indo-China main office.	2000.00 x 10 mos.		20,000.00
Freight charges	150 T	50.00	7,500.00
Supplies, utensils			5,000.00
		Sub-total	43,300.00

(5) Water Transportation facilities

The vessels used for water transportation on the R. Claire and R. Rouge would all be contracted for or requisitioned.

Grand total construction expenses	143,800.00 pi.
Amount of ore	88,000 tons
Rate (cost) per ton	1.63 piasters

(b) Materials needed for construction

(b) Materials needed for construction

The materials expected from Japan are as follows:

6-ton rail	3.0 km	ea. 15 tons	Ordinary steel	45.00 T
Same: related materials and reserves			" "	8.00
Crossings			" "	2.00
Steel plate for ore bins			" "	1.00
Hand carts	50 carts		" "	3.00
$\frac{1}{2}m^3$ ore cars			Ordinary steel Pig iron Special steel	10,00 2.00 Slight amount
Tools, and forge tools			Ordinary steel Special steel	0.50 Slight amount
Nails, bolts, nuts, clamps			Ordinary steel	2.50
Explosives				Slight am't
	Totals:		Ordinary steel	72.00
			Pig iron (vehicles and bearing cases)	2.00
			Special steel (bearings & drills)	Slight am't
			Explosives	Slight Amount

(c) Production Expenses

(1) Mining

The mining would be by open-cut terrace excavation. As the B deposit contains less than 10,000 tons of ore, mechanized conveyor equipment would not be set up, and the ore extracted would be hauled by hand cart to the ore-car loading point. As for the C Deposit, a branch line of about 200 meters would be installed from the main transportation line of A deposit.

Actual mining	0.35 piasters	(per ton)
Excavation	0.10	
Hauling	0.10	
Conveyor	0.15	
Explosives	0.20	
Supervision	0.10	
Miscellaneous	0.05	
Sub-total	1.05 piasters	

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(2) Transportation

From the mine to the banks of the R. Claire there would be installed 0.6-meter gauge 6-ton rail. At midpoint there would be set up a switch station. Each train would consist of 15 ore cars, for a total of 30. They would be capable of three round trips per day, moved by hand. The ore, being of excellent grade, has a high specific gravity. Since a $\frac{1}{2}m^3$ ore car could load 1.2 tons, the transporting capacity would be 108 tons per day.

Ore car loading	0.05 piasters
Hauling	0.20
Unloading and storage	0.10
Supervision	0.03
Miscellaneous	0.02
Total	0.40 piasters

(3) Water Shipment

Measuring the shipping distances according to the 400,000:1 communications map published by the French Indo-Chinese Government:

Mine loading point - Tuyen Quang city	20 kilometers
Tuyen Quang - Vie Tri	100 "
Vie Tri - Hanoi	60 "
Hanoi - Haiphong	120 "
Total	300 kilometers

In the 180 km between Vie Tri and Haiphong there are several places where there are shoals with only about 1.8 meters clearance during the low water period of the dry season. So, we were told that it is impossible for vessels of 100 tons burden to pass; only 70-to 80-ton vessels can navigate here. As for the distance between Vie Tri and the mine, we note the example of the shipment of ore from the Chodien Zinc mine and project a method for this mine by which specially constructed 15-ton steel vessels would be used for shipping the ore from the Nadon wharf on the bank of the Riviere Claire tributary, the Son Gam, to Tuyen Quang on the bank of the Riviere Claire. Here it would be trans-shipped in 30- to 50-ton vessels as far as Vie Tri. The total shipping cost for this distance is said to be 2.00 piasters. Consequently, we must give consideration to setting the wharf for this mine directly on the main channel of the Riviere Claire, but still the

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120 km from the mine to Vie Tri probably would have to be covered by 20- to 30-ton vessels; and the shipping rate - because of using contracted vessels - would be 2.50 piasters.

Loading		0.15 piasters
Shipping: Mine to Vie Tri		2.50
Trans-loading at Vie Tri		0.20
Shipping: Vie Tri to Haiphong		2.30
Unloading at Haiphong		0.25
Loading at Haiphong		0.20
Lighter loading		0.50
By lighter to depot ship		0.50
Supervision and miscellaneous		0.05
	Sub-total	6.65 piasters

(4) Other expenses

Ore production tax		0.15 piasters
Export tax		0.50
Current business		0.50
Portion of Haiphong and Hanoi office expenses		1.00
Amortization and profit		1.80
Royalties		0.50
	Sub-total	4.45 piasters

(5) Total expenses

Mining		1.05 piasters
Transportation		0.40
Water shipment		6.65
Other		4.45
	Total (F.O.B.)	12.35 piasters
Shipping: French Indo-China to Japan		12.00
	GRAND TOTAL	24.35
	Loss factor of 5%	25.57 piasters

Actual production costs are 25.57 piasters. When the profit of the managing company (stockholders' share) and the business expenses of the home company are added to this, the minimum cost on arrival in Japan would be ¥27.00. Under current market values for iron ore imported from overseas

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this would not pay. The major cause of the high cost is the internal water shipment cost that results from the long distance covered.

12. Conclusions

This mine has the strong points of high-grade ore; mining operations would generally be easy, and relatively simple land transportation. And, water shipment down the R. Claire and the Red River would be convenient for hauling out the ore; but it has the shortcoming of being a very long distance. The high cost of shipping over this distance is the major cause of the steep production costs. Simply facing up to these difficulties, we do not see that development would be allowable. Yet, to let the mine lie idle would be very regrettable indeed. The delivered price of this mine's ore in Japan has to be ¥27.00 at a minimum, which does not allow a profit under going market prices. However, since these shortcomings are countered under the immediate shortage of ore, a 3.00 to 5.00 yen loss could be absorbed from the selling price of the ore from this mine; or a subsidy could be paid; in eitharccase the development of the mine would be possible. However, though the total ore production would not be large, it would still be possible to supply Japan with about 30,000 tons of this high-grade ore (about Fe 65%) each year for three years.

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CHAPTER 4

THE IRON AND MANGANESE OF THE ANNAM REGION

Period of Survey: January, 1942

Surveyor: C Team, Iron & Manganese Group

Members: Koichi Fujimura, Secretary, Japan Mining Company, Ltd.
Masutaro Kato, Assistant, Japan Steel Pipe Co., Ltd.

Assistant: Kazuo Kobayashi

A. The Vinh Region

Section 1. Preface

The Vinh region of Annam State has been known in the past as the second most important iron and manganese ore reserve area after Tonkin State. It has already been surveyed by such companies as Mitsui Bussan, Japan Steel Pipe, Japan Iron Mining and Japan Mining. The mine foremen have been guided and assisted in taking out the ore by (1) Mitsui Bussan in the Xuan Loi region and the coastal region of Dong Ken in the main drainage basin of the Song Ca, (2) Mr. Shoshu Yokoyama in the Song Ca tributary region, and (3) Kishimoto Trading in the Yen Cu, Khe Quanh (also called Vo Nguyen) and Van Trinh areas of the Song Ca drainage basin. In each case the ore was loaded for Japan, so that this region has become famous as a support area for Tonkinese iron ore.

The members of the No. 3 Team of the Iron and Manganese Group, of the French Indo-China Natural Resources Survey Mission, have carried out a survey of this region, but there was no time for prospecting by clearing the forests or digging prospecting pits and trenches. Thus, from such a brief surface survey it is difficult to expect detailed data. We could only learn the essentials. We wish to call attention to the many ways in which we were assisted by Mr. Shoshu Yokoyama and Mr. Juan Ch'un-mei.

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Section 2. General Discussion

Location and Communications:

Vinh is in the north part of Annam State, is the No. 40 city of French Indo-China and is an area of concentrated resources. By the 6 AM diesel train from Hanoi to Vinh the trip takes six hours. All consider Vinh to be an important area for surveying and developing, among the mines and deposits of the country. The communications and transportation are made convenient by the Song Ca and the Cua Lo River systems, as well as by the seacoast area.

The areas surveyed are as follows:

	No. of Deposits Surveyed
1. Main basin of the Song Ca	3
2. Tributary area of the Song Ca	23
3. Cua Lo River drainage basin, i.e., Van Trinh region	1
4. Coastal region, i.e., Dong Ken region	5
5. Song Nguyen basin, i.e., the Thanh Da Den region	1

The last three above are small river basins, and the seacoast is not conspicuous as an ore reserve area. The concession names can easily be checked on the map to obtain the names. Only autos or small non-military vessels can reach these areas from Vinh. And, then, the distance to be walked is from 2 to 7 km.

The ore is mostly shipped by the rivers, the shortest haul being 1 kilometer in the Dong Ken region and the longest being the 77-kilometer haul in the Song Ca tributary region. The distances from the mines to the river banks range from 500 meters to 7 kilometers.

Names of Surveyed Concessions, No. of Concessions and Type of Ore

1 Song Ca main drainage basin	3 concess.	(Cf. concession locator map)
Yen Cu		Wolframite
Xuan Loi		Same
Khe Quanh		Same

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2 Song Ca tributary region:	9 concessions	
Thiet Buom	2 concessions	Iron Ore
Huong Thu	1 "	Same
Van Cu	1 "	Same
Dan Trai	1 "	Same
Da Bac	1 "	Same
Bao Deng	1 "	Same
Khe Truoi	1 "	Same
Trang Sim	1 "	Same
3. Van Trinh region	1 concession	
Van Trinh		Wolframite
4 Dong Ken region	2 concessions	Same
Dong Ken		
5 Thanh Da Den region	1 concession	
Thanh Da Den		Same

Terrain:

The ore deposit sites are separated into five regions, as noted above. They range over a broad area. The elevation of each site is 10 to 17 meters above the surface of the nearby river; they lie in rounded hills covered with dense grasses. It is mostly pastureland, but occasionally there are patches of dense woods, as on the south shore of the Song Ca tributaries; thus it is a range of wild elephants, tigers and leopards.

Geology and Ore Deposits:

The rock forming the regions of ore deposition is from the carboniferous period of the Palaeozoic era, according to the geological maps of the French Indo-China Mining Bureau. It is a region of sandstone, clay-slate, phyllite and quartzite. The strata generally run from northwest to southeast. The ore deposits of the region under survey this time all are the result of the permeation of the matrix rock due to the effects of weathering, or are second-generation metasomatose, exposed ore deposits. In four of the five regions the ore is limonite containing manganese. Only

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in the Song Ca tributary region is there no manganese contained in the limonite ore deposits. And, these deposits are not just scattered helter-skelter, but for the most part occur in the basins of the main tributaries of the Song Ca and are laid out in a fixed direction. That is, on the whole the Song Ca flows from northwest to southeast, and a part of its tributary Ngan Truoi River also forms a northwest-southeast line, suggesting paralleling structural lines here. Thus, the ore deposits are lined up like chains along the shores of both of these rivers with the same northwest-to-southeast direction.

Amount of Ore:

1. Region of the Song Ca Main Channel

The remaining ore in the Yen Cu ore region is estimated at more than 2,200 tons. It was closed down for a time, but after the occupation by the Imperial Army year before last it was reopened and is now producing five to fifteen tons daily. The Xuang Loi and Khe Quanh ore regions are near to early exhaustion; and since they will soon cease operations, there should be no computation of the remaining ore. Yen Cu and Khe Quanh belong to the Sanko Company, Ltd. (Kishimoto Commercial), while Xuang Loi belongs to Mitsui Bussan. And, the ore is being bought by these companies.

2. Song Ca Tributary Region

In 1937 Mr. Shoshu Yokoyama established connections with this region's ore areas and did some mining. Part of the ore is stored at the mouth of the Song Ca. From 1939 the export of the ore was prohibited, and other factors in addition forced a halt to operations. Thus, other areas are totally undeveloped. The amount of ore estimated for the parts surveyed this time is 90,000 tons; but with the possibility of new ore deposits being discovered hereafter, the amount of ore could be increased.

3. The Van Trinh Region

This deposit is still in its initial period of development; and including the mined ore in 6,324 tons - the total amount of ore is about 40,000 tons.

Breakdown:	Iron ore	over 39,000 tons
	Wolframite ore	500 tons
	Manganese ore	150 tons

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4. The Dong Ken Region

Of these two concessions, Mr. Yokoyama has an association with the Chen Tien concession; and Kishimoto Shoji (Trading), with the Dong Ken concession.

Amount of Ore in the Chen Tien Concession

Total amount of ore		6,615 tons
Breakdown:	Iron ore	4,981
	Wolframite ore	1,218
	Manganese ore	416

Total amount of ore for the above five concessions:

Iron ore	148,900 tons - plus am't exported =	200,000 tons
Wolframite ore	3,500 - plus am't exported =	11,500
Manganese ore	1,900 - plus am't exported =	10,600

The ore and its grade:

Average grades -	Iron		50 - 53%
	Wolframite	Iron	30 - 40%
		Manganese	10 - 20%
	Manganese		40 - 43%

Mining Method and Ore Grading:

With the surface deposits, open-cut mining would be followed, using picks, shovels and large and small hammers [air hammers?]. A relatively small amount of explosive would suffice. Sorting of the ore would be by hand.

Amount of Ore Production

Yearly production, Song Ca tributary region:	Iron ore	30,000-36,000T
Van Trinh-Dong Ken total	Iron ore	30,000
	Wolframite ore	500
	Manganese ore	500

Base costs	Simple cost at mine Transportation Miscellaneous costs	8.00-9.00 piasters, F.O.B. the seacoast, with some variation from site to site.

Method of Transportation

6-ton rails would be installed to the river bank and hand-push carts rolled from the deposits by the natives. Then lighters would ship the ore via the water routes to the seacoast.

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Anticipated Future Production Increases

By mining the new ore deposits that should be discovered hereafter, as well as by increasing skills, some natural increase in production is believed to be possible.

I. Song Ca Main Course Region

Outline:

The Song Ca basin in general is broad, flat and low with developed paddy fields. At the east end it is 20 km wide in a straight line, and at the west end about 10 km. Pressing in on the river from the southwest shore are ranges of mountains such as Ru Tram (287 meters), Ru Lai Hai (238 mtrs) and Ru Trei (192 meters), forming the North Ke Nhiem Mountain Range.

In various locations in this region there are exposed, remnant deposits of iron and manganese ore, and a great number of these have been established as concessions. But, the conspicuous ones are Khe Quanh and Xuan Loi. The former is located south of Ru Tram [a mountain] at the north end of the North Ke Nhiem range on the left shore of the Khe Quanh River. The latter is at the south end of the same range on a southerly spur of Ru Tcet [sic]. Again, fourteen kilometers downstream where the river turns northeast, on the north shore at Yen Cu there is a single line of low hills. Here there are two concessions, one of which has been developed.

These are the three concessions surveyed this time:

Concession Name and Area

1.	Yen Cu	1 concession	Area: 716 hectares
2.	Xuan Loi	1 concession	900 hectares
3.	Khe Quanh	1 concession	540 hectares

Holders of Mining Rights

1. Bui Huy Tin, Hue
2. Same
3. Nguen Xuan My

Actual operator of the three concessions: Phuc Thanh et Nha

Ore agents: 3. Sanko Company, Ltd.

2. Mr. Shoshu Yokoyama

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In addition, there are eleven ore prospecting areas not surveyed this time.

1. Yen Cu Concession

Location and Communications:

The concession is located in Yen Cu on the north shore (left bank) of the main course of the Song Ca near its point of confluence with a tributary, this being 12 kilometers SSW of Vinh, a famous city of the northern part of Annam. To reach this site from Vinh, one simply motors by auto for about ten kilometers directly southward on Colonial Highway No. 1; then one turns westward, following the village road for two kilometers to the mine. So, communcations are easy and convenient. It is about 600 meters from the mine to the storage depot at the river's edge. Here the ore is sorted and loaded into the lighters from the wharf. Then, it is shipped to the Hai Yen storage depot at the mouth of the Song Ca, 35 kilometers away. The lighters carry 45 tons, and can make the round trip in two days.

History:

The Sanko Company, Ltd., became associated with the Annamese men Tin and Nguen in 1935 and set about mining the manganese ore of the Yen Cu concession. This was exported to Japan along with the iron ore produced together with the manganese. The amount of ore exported until 1939 was as follows:

Manganese ore	approx.	8,000 tons
Wolframite ore	"	8,000
Iron ore	"	27,000.

From 1940 on, export was prohibited; and because of other factors, too, operations were suspended. But, upon the occupation by the Imperial Army it was reopened. At the time of the survey about thirty coolies were employed in mining the manganese ore. From 1941 to the present, 300 tons of manganese ore had been exported to Japan. And, we were told that at present there are 100 tons of the ore stored at Haiphong.

Terrain:

This mine is on one of the sole remaining hills on the broad alluvial plain that is part of the Song Ca basin. Its highest part has an elevation of about 150 meters above the surface of the Song Ca. This hill is the site of a former fort; the fortifications were built in the shape of pincers facing southward from the peak. The Song Ca, which is the main traffic artery for the inhabitants of this region, comes from the north-west, and just at the west side of this hill the tributary Ngan Lan River comes in from the south, meeting the main stream in this vicinity. Thus, this must truly be called a convenient spot communications-wise.

Geology and the Ore Deposits:

The geology of the area is of the Palaeozoic era (Carboniferous period) and is composed of clay-slate, breccia and quartzite. The strike varies according to location from N80°E to west. For the most part the strata run east and west and incline to the north 55°. The ore deposit generally follows the strike of the matrix rock and is made up of limonite and manganese ores, forming a number of gangue groups at the southern foot of the hill. However, these are not the original, but result from the weathering effects on the surface and gradual secondary infusion and meta-somatosing of the underlying rock.

These gangue groups can be classified into four groups, as follows:

No. 1 Group

In this group there are four main veins. A vein, the most southerly of them, is a limonite ore vein of about one meter width. It is low grade - believed to be about Fe 38%. North of this, separated from it by six meters of matrix rock, is the B vein. This, too, is one meter wide, composed of 20 cm of wolframite ore, 10 cm of manganese ore alone and again 60 cm of wolframite ore. The last 10 cm is manganese ore. The above A and B veins run westward for ten meters, becoming thin veins gradually. The A vein narrows down to 60 cm width, of which 50 cm is limonite of Fe 50% grade, the other 10 cm becoming manganese ore. The B vein turns into a 20-cm vein of manganese ore. Then the two close on each other and finally join into a single body. One meter beyond this the width increases to 1 meter 30 cm of iron and manganese ore together. Again, after 30 meters more there is only good-grade manganese ore. Then, 5 meters further along the limonite is again mixed in. Thus, after some 70 meters the vein runs out. Two meters away from the B vein is the C vein, with a width of about one meter. Of this, 40 cm is iron and manganese ore and 10 cm is

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manganese only - this much being handled as ore. The rest is low grade, an admixture of iron and manganese. It continues on, but not continuously; and after forming recoverable lumps in some twelve places, it ends. Again, after a gap of a number of meters there is the D vein; but all that can be seen is traces of its having been excavated, with no ore remaining. Thus, on the whole, the Number 1 group is valuable only in the A-B joint vein, which extends for 70 meters and is deposited to a depth of three to four meters.

No. 2 Group

This is removed from the No. 1 group by some twenty meters and shows irregular evidence of mining. Part of it is good grade limonite in the form of boulders, which are being mined. But, if it has no extension, there is not enpugh ore to bother with.

No. 3 Group

In this group three or four trenches are to be seen, but it is not as wide as the Number 1 group, being iron and manganese ore just 20 to 30 centimeters wide.

No. 4 Group

This is separated from the previous group by thirty meters; it is a comparatively large outcropping near to the fortifications. The general width os ten meters, with five occurrences of manganese ore 50 cm wide, 10 meters long and 6 meters thick. Its extensions are not obvious. Also, there is included matrix rock of three to four and up to seven meters in width in several places. In the outcroppings the ore grade is not good.

Across the valley from the No. 1, 2, 3 and 4 groups of the ore deposit is a limonite deposit. It is 200 meters long and 70 meters wide, with four lines running intermittently. The whole body permeates into the strike of the matrix, running N70°-80°W. In contrast to the comparatively manganese-rich ore deposit on the above fortress hill, there are very few points where there is any manganese content.

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Amount of Ore, Grade and Kind of Ore

Fortress Hill - Joint A-B vein of Group No. 1

Dimensions   70m x 1.0m x 3.5m = $245m^3$

$245m^3$ x 4 tons = 980 tons - or 1,000 tons

1000 x $\frac{1}{2}$ = 500 tons ....iron,manganese ore

1000 x $\frac{1}{2}$ = 500 tons ....iron ore

Group 2 (5m x 2m x 3m) x 4 = $30m^3$ x 3 = 120 tons .... iron ore

Group 4 (10m x 2.5m x 10m) x 4 = $250m^3$ x 4 = 1000 tons .. iron ore

Totals   Wolframite ore   500 ......(manganese ore 500x1/3=167T
(wolframite 500x2/3 = 333T

Iron ore   1,620 ..... iron ore 1,600 x 7/10 (grading rate) = 1,120 tons

Western Area Deposits

I   20m x 1m x 2m x 3 tons = 120 tons .... wolframite ore

II   10m x 3m x 2m x 3 tons = 180 tons .... iron ore and wolframite

Of this: (180 tons x 2/3 = 120 tons .... iron ore
(x 1/3 = 60 tons .... wolframite ore

III   23m x 2m x 2m x 3 tons = 276 tons .... iron ore

IV   40m x 1m x 2m x 3 tons = 240 tons .... iron ore

V   3m x 2m x 2m x 3 tons = 36 tons ....wolframite ore

Totals
636 tons x 0.7(grading rate) = 445.2 tons ...... iron ore
216 tons x 0.7(grading rate) = 151.2 tons ...... wolframite

GRAND TOTALS

Iron ore 1,120 tons plus 445 tons = 1,565 tons)
Wolframite 333 tons plus 151 tons = 487 tons) 2,216 tons - or
Manganese ore 167 tons) about 2,200 tons

Grade

Iron ore (when graded)   52 - 53%

Wolframite ore   Iron - 30-45%
Manganese ore - 40-45%
Manganese - 20-25%

Quartzite content in each ore is under 10%

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Assay values for the ore are as follows:

No.	O.W.	Fe	SiO_2	Mn	Al_2O_3	CaO	MgO	S	P	Note
5748	10.60	44.10	0.86	6.26	2.95	—	0.13	0.066	1.371	iron ore
5948	10.13	40.33	1.02	9.06	2.87	—	0.12	0.014	1.410	wolframite
5953	4.56	4.12	0.06	53.52	1.13	—	0.08	0.006	0.424	manganese ore

(Assay by Japan Steel Pipe Co., Ltd. 1942)

Amount of ore already mined

In the Hai Yen storage depot there are 2,972 tons of iron ore, 545 tons of wolframite ore and 374 tons of manganese ore: total storage of ore - 3,891 tons.

Amounts already exported: Iron ore - 27,000 tons

Wolframite ore - 8,000 tons

Manganese ore - 8,300 tons

Total - 43,000 tons

GRAND TOTAL 47,191 tons

Kinds of ore

The iron ore is limonite ore.

The manganese ore is hard and soft manganese ore.

Method of Mining:

This kind of ore deposit originates from the secondary stratification of the rock and from the permeation of crevices and holes. Being located at the foot of a hill, several meters of its lower part are buried, but here pit mining would not be suitable. Also, not only is there no standard of grade along the whole length of the ore deposit, but also since a large part of it already has been mined no method should be used other than just excavating the good parts along the seam by open-cut mining.

Grading the Ore:

The crude ore is around 40% iron and 30% manganese ore. So, it is necessary, as it has been in the past, to increase the grade to 52-53% iron and 40-43% manganese by hand sorting.

Base Cost (per ton) from Minesite to Depot Ship Loading:

A. Mining (20 tons/day production)

Due to the conditions of the deposit, future mining methods would follow the open-cut stripping method previously employed. In the mining, blasting would sometimes be used. If 0.2 tons of refined wolframite ore and manganese ore were to be produced per man per day by coolie labor and the pay were $0.50 per day, the per-ton cost would be $2.50. As the sorting (grading) of the ore at the minesite would require five women, this cost would be $2.00. The sorted proportions would be: manganese ore - 1.5, wolframite ore - 2.5, iron ore - 6.5.

B. Minor Conveyances

From the site of the mining to the storage point at the side of the river a single cart could make twenty round trips when pushed by hand. If the load capacity is forty tons and 0.8 tons could be hauled per person per day, the cost per ton would be 0.63. And, the cost of explosives would be 0.17 per ton.

C. River Shipping

Using the native craft (10 - 17 ton burden) and a reserve of four lighters (50-ton burden), with crews of five for the native craft and fifteen for the lighters, the ore could be taken to the Hai Yen landing. Loadingfrom the minesite storage depot would be handled by coolies of the mining crew. This expense would be 0.20 (3 tons/person/day), while the river shipping from the river shore at the mine to storage at Hai Yen would be contracted, and is said to run 1.20 per cubic meter (1.7 tons). Thus, calling this 0.70 per ton, the total is 0.90; and from the mine to storage at Hai Yen the overall total would be 6.40.

D. Depot Ship Loading Costs

As noted in the chapter on the Van Trinh concession, the cost to load the ore onto the depot ship was 2.77, making the F.O.B. base cost 9.17.

This is somewhat high priced, but in view of the emergency some allowance must be made.

Conclusions:

If very little ore remains, the mining, shipping and other facilities on the land cannot be supported; and the policy will have to be to mine the ore only by the makeshift methods followed heretofore.

2. The Xuan Loi Concession

Location and Communications:

From Vinh in Annam State to Nam Dang the roads are good. But, from here for six kilometers by the village road along the Song Ca to Cho Hong autos cannot make it, so that the distance has to be covered on the Song Ca by small native craft. To reach Xuan Loi, four kilometers beyond Cho Hong, one walks westward until arrival at the concession. Thus, there are but 4 km of land transportation required from the concession to the main stream of the Song Ca, and from there lighter shipping is available. So, the location is good from the standpoint of communications and transportation.

Terrain:

Ru Tret (192 meters) is at the south end of the K. Nhiem range, which rises up close by the right bank of the Song Ca and which faces Dong Bai Mountain (240 meters) at the north end of the Nuy Cheng Nyan [phon. approximation] mountain range. Between runs a small un-named tributary flowing into the Song Ca. Here the Song Ca suddenly turns from a north-to-south flow to east-west. The width of the river increases, forming great sandbars.

Geology and the Ore Deposits:

The rocks of this neighborhood are clay-slate, quartzite, etc., running on a N50°W strike and sloping to the northeast 65°. They belong to the Devonian and Silurian periods of the Palaeozoic era. Large parts have been permeated with limonite. And, the rocks along the Song Ca have been surveyed in the past by many people. In the region at the south foot of Ru Tret there are traces still remaining of extensive prospecting by Mitsui Bussan.

This ore deposit is on a spur on the west of Ru Tret. It is a flat-topped hill of 120 meters elevation (70 meters on the west side), rising 20 meters above the surface of the paddies below. Following the strike of the rock is the deposit of ten meters width. Of this, many 2 - 20 cm intermittent bands of wolframite ore occur. Herein the manganese often predominates, while in some parts it is solely limonite. But, the latter is not a problem, being insignificant in amount. The portion having enough manganese to warrant mining is comparatively mixed and is

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lens-shaped, swelling from a width of about 20 cm to 50 cm. But, as it fades out, the paralleling veins swell out, so that it has a length of about 20 meters, a width of 30 cm and a thickness of around 5 meters. If each cubic meter is 4 tons:

Amount of ore -

$$20 \times 5 \times 0.3 \times 4 = 120 \text{ tons}$$

Amount of ore	120 tons	...... manganese ore
Stored at mine	177 tons	...... manganese ore
	234 tons	...... iron ore

The Ore and its Grade :

The ore is hard manganese with a grade of over 42% manganese content - comparatively good. Besides this, there is limonite, but of a poor grade with no value for working. The assay values are as follows:

No.	C.W.	Fe.	SiO_2	Mn	Al_2O_3	CaO	MgO	S	P	[redacted]otes
5934	—	2.93	1.51	52.15	1.89	—	Tr.	0.0(7	0.370	S[redacted]manganese ore
5935	9.95	32.53	2.86	20.36	3.40	—	[illegible]	0.079	1.229	S[redacted] iron ore

(Assay by Japan Steel Pipe Co., Ltd., 1942)

Transporting the Ore:

There is not a great amount of ore; thus this is not a mine that would enable rails to be installed. Instead, carts or trucks have to be used to do the hauling from the mine to the shore of the Song Ca. And, just the simplest of piers will suffice as a wharf on the river shore. The distance formshipping by boat on the Song Ca is 50 kilometers.

Conclusions:

This mine was developed under the guidance of a Mitsui Bussan supervisor; and that company purchased the ore. But, thereafter the operations were suspended, leaving ore remaining in narrow veins. Now the policy should be to look for the opportune time to bring out the remaining ore to the storage point at the mouth of the Song Ca tributary.

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3. The Khe Quanh Concessions

Location and Communications:

The concession is reached by travelling by auto westward twenty-five kilometers from Vinh in Annam State, and then continuing on foot for about 2 kilometers, coming out on the shore of the Song Ca. Then one travels downstream by native craft for about three kilometers and turns up the tributary Khe Quanh River.for some four kilometers. Arriving below the minesite, one finds that the ore is 200 meters from the stope. The lighters used for shipping the ore brought to the river bank are 15-ton lighters. The distance for water shipment is about 70 kilometers. The trip each way takes three days, a six-day round trip, which is rather convenient for water transportation in French Indo-China.

Terrain:

The left bank, or the south shore, of the Song Ca tributary, the Khe Quanh River, is paralleled by a low line of hills, with a high point of 115 meters.

Geology and the Ore Deposit:

The geology of this vicinity is made up of palaeozoic (Devonian and Silurian period) clay-slate and quartzite. These follow a strike of N50-70°W and a gradient to the northeast of 50-80°. The iron ore is on the north side of the hills, distributed up twenty meters from the foot of the hill. Here there are no ore stones on the surface of the ground; but it is limonite ore that permeates and metasomatoses the clay-slate matrix and either matches the strike of the matrix or enters into the crevices and fissures as a gangue form of the ore. Its distribution is to the northwest for about 750 meters, being in general of good grade, around the foot of the hill. already 7,000 tons of ore has been mined from stope C, and from the mine the amount already mined is said to reach 16,000 tons. All of this was from the foot of the hill. The ore higher up is not of good grade and resembles the matrix; it cannot be called ore. In the ore of stopes A and F there is manganese contained, in most places reaching 10%. This concession is on loan by Phue Thanh from Bui Hug Tin and is mined by him, while the ore is purchased by Kishimoto Shoten (Co.). And, up to about 1939 the above-noted 16,000 tons of ore had been mined and shipped. Since then, the work has been halted. In general, it must be said to have been mined out, with almost no ore for computing the amount remaining. In C stope, with a width of two meters, there is a remaining permeation vein; and in F stope there is a section of iron ore 18 meters long, 4 meters wide and over 1 meter deep, as well as a section 5 meters long and 3 meters wide containing manganese.

The Ore and Its Grade:

The ore is limonite, and by handsorting the grade - iron content - can be raised to 52%; the iron portion of the wolframite can be raised to 30 to 35%, and the manganese, to 10 to 15%.

Below are given the assay values:

No.	O.W.	Fe	SiO_2	Mn	Al_2O_3	CaO	MgO	S	P	Notes
5928	5.85	21.41	54.30	0.07	5.48	—	Tr	0.003	0.697	iron ore - poor
5929	11.04	54.19	5.28	0.23	2.57	—	"	0.003	1.[illegible]	iron ore
5930	10.83	49.88	9.70	0.73	3.70	—	"	0.003	1.151	Same - stope C
5931	9.03	52.87	1.10	5.67	1.65	—	"	0.045	0.766	Wolframite - Stope F

(Assay by Japan Steel Pipe Co., Ltd., 1942)

Conclusions:

The amount of ore remaining is not great; and insofar as no separate ore deposits are discovered in the vicinity, it would be difficult to operate the mine. Surveys of the ground must be made in other parts of this region.

The three concessions of the Song Ca Main Basin, i.e., Yen Cu, Xuan Loi and Khe Quanh belong to the same zone, being on a line from northwest to southeast and all three containing the same kind of wolframite ore. In the fact that all are secondary ore deposits formed by the effects of weathering they are seen not only to have the same origin but also to have points in common from the standpoint of operations and transporting the ore, and in using the Song Ca. The fact that the ore contains manganese and that it is near to Vinh, the capital of North Annam - Yen Cu being 12 kilometers away and Khe Quanh, 34 kilometers - is extraordinarily convenient. Japanese enterprises in French Indo-China at first extended to Yen Cu, then to Xuan Loi and finally to Khe Quanh, gradually moving farther

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and farther out. However, as noted above, all are surface ore deposits, the shallower ones being several tens of centimeters deep and the deeper ones being no more than several tems of meters. And, their continuity is weak. In each ore deposit there are gradations, yet within each concession there are no large amounts of ore deposited: all three mines are close to exhaustion. The latter two are shut down, while the first is being exploited by Annamese who are turning out a daily production of five to fifteen tons.

While there could be no speedy mining of the previous ore bodies, great effort should be expended toward discovering other ore bodies in this zone.

II The Song Ca Tributary Basin

Outline

The Ngan Truoi River is a tributary of the Song Ca. Its upper half takes a southwest to northeast course, while the lower half, i.e., the part where it enters the area of iron ore deposition surveyed this time, suddenly turns its channel east and west. And, for about ten kilometers it runs northwest to southeast. Two tributaries running into it - the Hoi Truoi River cmining from the northwest, and the K. Buom River coming from the southeast - have the same direction as the main channel, and the three together form a straight line. The ore deposits are at points along both sides of these three rivers. Their area of distribution extends for more than 20 kilometers; and the deposits all lie close to each other. The Ngan Truoi River is used as a communication channel to this region. Also, the shipping of the ore is all over this river. And, since geographical conditions as far as Hai Yen on the Song Ca are the same as in the case of the main stream, the Song Ca tributary region can be dealt with as a unit.

Locations and Communications:

To reach this region, one goes by train from Vinh, capital city of An Province, Annam State, and travels south for about 36 kilometers, for $1\frac{1}{2}$ hours, getting off at Hoa Duyel station. In small native craft, one

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goes up the Ngan Truoi River for about 10 kilometers. After $4\frac{1}{2}$ to 5 hours one reaches Huong Thu village at about the center of this region. The area of the ore deposits is a part of Ha Tien Province and, as already stated, the deposits extend across the main basin of the Ngan Truoi. All are but a short distance from the shores of the river, the nearest being 300 meters and the farthest, within 7 kilometers. From the center of the region to the mouth of the Song Ca the distance for boat transportation is 77 kilometers. Over this distance, the ore is carried by 5-ton vessels for 27 kilometers to An Phu; and below An Phu to the storage point at Hai Yen on the mouth of the river, a distance of 50 kilometers, 50-ton lighters can be used. For the whole round trip three days are required.

Thus, this region is one where both communications and transportation are quite convenient.

The Concessions and Their Areas:

Three mining concessions	Total area 15 sq. hectares
14 prospecting concessions	Each 3 hectares square = 126 sq. hec.
Holder of mining rights	Nguen Xuan My
Agent for selling ore	Shoshu Yokoyama

Terrain:

The two tributaries, Hoi Truoi and K. Buom, and the Ngan Truoi River into which they flow, have a northwest-to-southeast direction, i.e., roughly N60°W, forming a straight line and revealing the existence of structural lines. On the northern side - the left shore - are aligned such mountains as N. Dong Coe (160 meters), N. Dong Voi (120 meters) and N. Kay Cao (127 meters); while on the southern part - the right shore - are the mountains N. Dong Chua (125 meters), N. Dong Dung (250 meters). These ranges are cut into by numerous lateral vallies; and approaching the Ngan Truoi, they gradually become lower. The vicinity of the river shore is a hilly region of 20 to 70 meters high round peaks shaped like inverted bowls.

Geology and the Ore Deposits:

The rocks forming this region are clay-slate, quartzite and phyllite. According to the geological map of the French Indo-China Mining Bureau, they belong to the Carboniferous period of the Palaeozoic era. On the south side of the Ngan Truoi River are outcroppings of granite.

The iron ore deposits extend over the whole region and are limonite ore. They are found on the lower slopes of the hills lining both shores of the Ngan Truoi River, occurring intermittently at points along the course. Considering the origin of these ore deposits, we believe that originally they may have been formed as a certain kind of igneous deposit related to the granite seen in this vicinity; and over a long period of time the matrix rock was broken down by exposure to the tropical heat and rains, as a result of which the iron contained therein dissolved out and settled down in suitable spots underground to form permeated and metasomatose limonite ore deposits. But, the effects of weathering still not being halted, the limonite deposits again were broken down into many ore boulders which rolled down the hillsides. At the same time, the ground water that dissolves the iron of the rock continuously exerted its effects; and, as is known from the evidence of the mining in the Huong Thu and Van Cu regions, it formed hard nodes of limonite ore, which in turn had metasomatosed with the matrix rock through permeation. Then, in the mines, besides the loose boulders accumulated on the surface, this nodular part is broken up and excavated. The ore in the form of boulders and stones does not anywhere form thick strata, because of the nature of its origin. But, in the case of the exposed ore deposits, they are never found on top of the high peaks; and they are of poor grade. They still retain characteristics of the matrix rock; and to date none have been found that have any economic value. Nor should any be expected to be found in the future.

For the sake of convenience, in discussing the individual ore deposits we will divide them into the following seven areas - moving progressively from south to northwest and northeast:

1. Huong Khe area (Thiet Baom)
2. Huong Thu area
3. Van Cu area
4. Dan Trai area
5. Da Bac area
6. Khe Truoi area
7. Trang Sum area

Discussion of each area:

1. Huong Khe area

The Ngan Truoi River bends sharply between Khe Quanh and Moc Bai, and here the K. Buom River flows in. If one follows this river for over 2 kilometers to the southeast, one reaches Thiet Buom village. Here, at the northwest limit of the area there is ore to be found on three small hills on the left shore.

No. 1 Deposit - in a small mound rising three meters above the paddy fields, with a length of 20 meters and a width of 10 meters: irregularly scattered limonite boulders. There is one prospecting pit one meter deep; but there is no buried ore. There is not enough ore to compute the amount, and its grade is not good.

No. 2 Deposit - located over 100 meters southeast of the above deposit on a flat-topped hill having a height of around fifteen meters above the paddy fields. The ore is distributed over a range 120 meters long by 50 meters wide. Though there are prospecting pits at both the north and south ends of the deposit, there is no buried ore. There is less than half of the amount of ore needed for economic managing of a mine:

Amount of Ore

120m x 50m x 1.0m x 0.1 tons = 600 tons

So, the amount of ore is estimated at 600 tons

No. 3 Deposit - Some sixty meters southeast of the previous deposit, across the paddies, is a small 60-meter hill where ore is found over an area 200 meters by 60 meters. Two prospecting pits have been dug on the hill, with the northernmost one showing almost no ore and the southerly one having ore deposited one meter deep. The pits are two meters long and one meter wide - rectangular in shape; and the topsoil is 15 centimeters thick. Below this for about one metersis breccia and the ore.

Amount of Ore

Length		Width		Depth	
200m	x	60m	x	1.0m	x 0.2 tons = 2,400 tons

The amount of ore is estimated at 2,400 tons - the best ore deposit in this region. About $2\frac{1}{2}$ kilometers southeast of here in the southeast corner of the region there is one other ore deposit, but as the grade is not

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good and is not enough to be managed, we will omit it.

Grade:

The assay values for the ore in each deposit are as follows:

No.	C.W.	Fe	SiO_2	Mn	Al_2O_3	CaO	MgO	S	P	Notes
5925	11.24	57.90	3.02	0.06	1.46	—	Tr	0.039	0.651	No. [illegible] Ore Deposit
[illegible]	10.14	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.163	N[illegible] Ore Deposit
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	N[illegible] Ore Deposit

(Assay by Japan Steel Pie Co., Ltd., 1942)

2. The Huong Thu area

In this area thereaare three sites at Huong Thu and one at Dong Bo, for a total of four hills where the ore is distributed.

Huong Thu No. 1 Ore Deposit - This is one connected with, and mined by Mrs. Shoshu Yokoyama, who resides in Haiphong. The present office is at the approach to this hill. It is 42 meters above the water level of the river. The rocks forming this vicinity are clay-slate, quartzite and phyllite. The quartzite is milky white in color; and, being hard, it lasts in outcroppings for an especially long time. Its strike is N50-60°W, and the gradient is not clear, but is something like 45-50° to the west.

The ore deposit is made up of boulders and stones on the surface of the ground, as well as permeated iron ore. Its dimensions are 250 meters by 140 meters; and the part at the foot of the hill has already been completely mined.

Amount of Ore

Total area 250m x 140m = 35,000m^2

Remaining area 120m x 90m = 10,800m^2

This kind of ore deposit is comparatively rich near the foot of the hill, while near the summit it is very poor. As an example of this, the area of remaining ore is 10,800m^2, with 0.2 tons per cubic meter, which works out to 2,160 tons. However, it would probably be barely possible to extract even one fourth of this - or 540 to 600 tons.

Ore now in storage at mine 2,664 tons refined ore

Ore in storage at river mouth 4,314 tons

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Huong Thu No. 2 Deposit - Located about 350 meters southeast of the above deposit on a 32-meter hill. The ore is distributed in an area 180m x 70m. Two-thirds of it have already been worked.

Amount of Ore

Length Width

180m x 70m = 12,600m^2

12,600 x 1/3 = 4,200m^2 not yet worked

4,200m^2 x 0.1 = 420 tons

Now in storage: 2,733 tons refined ore

Huong Thu No. 3 Deposit - Northeast of the above two deposits, about 600 meters from them, a loose-rock deposit at the foot of the hill. The ore area has an admixture of white quartzite. The dimensions of the area of distribution are 250 meters by 60 meters, all of which has already been mined.

Amount of Ore

Length Width

250m x 60m = 15,000m^2

15,000m^2 x 0.2 tons = 3,000 tons, now in storage at the mine

The ore now stored at the mine is not of good quality; and even with sorting of the ore, it is believed that the best grade would be less than 50%. The milky quartz at the above three hills occurs to the west of Deposits No. 1 and 2 in a single line and in the middle of No. 3 hill, as well as in one line on the east side of No. 3 deposit. All of these follow a strike of N50°W.

Ore now in storage: 1,432 tons refined ore

The Dong Bo Ore Deposit - on the left bank about 1½ kilometers upstream from the mining office of the Huong Thu No. 1 Deposit, 400 meters northeast of the river shore at an elevation of around 70 meters above the surface of the river on a rounded hill. The ore is limonite boulders distributed within an area measuring 100 meters by 50 meters. The large boulders are 60 cm in diameter. The matrix rock is slate, phyllite and quartzite. The limonite has permeated into this and metasomatosed it, so that the quality is not good. Here, too, the west side of the ore deposits touches

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it. Because the grade is not good, the amount of ore is 1/3, or 300 to 400 tons only.

Amount of Ore

Length Width Depth

100m x 50m x 1m x 1/3 x 0.2 tons = 334 tons, or 300 tons

Although this ore deposit was not surveyed this time, the operators sis survey it in August of last year, as in the appendix.

The grade and assay of the ore of this region is as follows:

No.	O.W.	Fe	SiO_2	Mn	Al_2O_3	CaO	MgO	S	P	Notes
5910	11.02	55.14	4.28	0.13	3.77	—	Tr	0.045	0.571	A Storage
5951	10.58	55.[illegible]	4.12	0.02	3.43	—	0.10	0.068	0.483	
5952	11.05	56.71	3.54	0.07	2.78	—	0.11	0.063	0.551	
5953	10.45	55.37	4.90	0.06	3.48	—	0.12	0.020	0.415	
5954	10.92	54.72	2.95	1.73	1.06	—	Tr	0.010	0.714	
5955	11.30	56.81	2.15	0.64	0.68	—	〃	0.016	0.814	
5959	10.17	54.27	5.66	0.02	4.42	—	〃	0.032	0.832	
5960	11.17	59.04	1.72	0.07	1.26	—	〃	0.012	0.366	
5961	11.11	57.68	3.00	0.07	2.10	—	〃	0.025	0.410	

(Assay by Japan Steel Pipe Co., Ltd., 1942)

Transportation:

The No. 1 and No. 2 ore deposits of the Huong Thu first region are close by the river bank. And, even the No, 3 deposit is no more than 600 meters from the No. 1 hill, so the land roads would be very convenient.

3. The Van Cu Region

In this region there are four ore deposits occupying the north shore of the Ngan Truoi River and neighboring on Huóng Thu on the north-west. Almost all of the ore deposits are connected.

Van Cu No. 1 Ore Deposit - Located on the left shore of the Ngan Truoi River, 2 kilometers upstream from Dong Bo. The Phyllite matrix runs N60°W and slopes to the west at 70°. The ore is found at a site less than 30 meters above the river surface. Within its dimensions of 250 meters by 30 meters there are large and small boulders and stones with diameters from two meters down to fist size. As the grade is not good, the amount of ore will be computed at one third of the total.

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Amount of Ore

Length Width

250m x 34m = 8,000m^2 x 1/3 = 2,833m^2 x 0.2 = 566 tons

The amount probably should be around 600 tons.

Van Cu No. 2 Ore Deposit - Located across the valley directly to the northwest, the ore deposit is connected with the previous one. The ore rocks cross the hill rising 40 meters above the surface of the ravine and extend to the opposite side [of the hill]. There are not many large rocks, the maximum being one meter in diameter. The south side of the hill, the side facing the hill of the No. 1 deposit, has poor grade ore with few of the rocks rating as ore. But, those from the peak downwards on the northwest side are of good quality. The quartzite running throgh both sides of the ore deposit extends for 77 meters, with the ore rocks lying in between in an area measuring 100 meters by 80 meters.

Amount of Ore

Length Width

200m x 80m = 16,000m^2

Depth

16,000m^2 x 1m x 0.2 tons = 3,200 tons

The amount of ore is estimated at about 3,200 tons.

Van Cu No. 3 Deposit - This is 250 meters away from the No. 2 deposit, to the northwest across the valley. The part at the foot has already been mined, and the amount of ore remaining is slight. The ore in storage amounts to about 1,000 tons of refined ore.

Van Cu No. 4 Deposit - Between this deposit and No. 3 Deposit is a single small valley separating them by only about 100 meters on the northwest. Here, too, the part at the foot has been mined. There is a fairly bread distribution of ore rocks on the surface of this hill, the remaining ore being estimated at 10,400 tons.

Amount of Ore

Length Width Depth

450m x 130m x 1m x 0.2 tons = 10,400 tons

The ore in storage amounts to 1,724 tons of refined ore - for a total of 12,124 tons.

Here, too, there are two lines of quartzite flanking the ore deposit, with a gap of 130 meters in between.

The grade of the Ore

The following is the assay of the grade of the ore in each ore deposit:

No.	O.W.	Fe	SiO_2	Mn	Al_2O_3	CaO	MgO	S	P	Notes
5920	10.00	53.52	6.40	0.25	3.74	—	Tr	0.024	0.519	No. [illegible] Ore Deposit
5921	11.63	52.33	4.68	0.25	4.31	—	〃	0.094	0.290	No. [illegible] Ore Deposit
5956	11.38	57.41	2.01	0.83	0.18	—	〃	0.007	0.602	
5957	10.74	56.22	3.73	0.41	1.22	—	〃	0.013	0.739	
5958	10.63	53.23	5.66	1.14	1.40	—	〃	0.010	0.768	

(Assay by Japan Steel Pipe Co., Ltd., 1942)

4. Da Bac Region [Japanese phonetics read Dan Trai]

In this region there are two ore deposits, one on the left shore (north shore) and one on the right shore of the Ngan Truoi River.

Dan Trai No. 1 Deposit - About 600 meters northwest of Van Cu No. 4 deposit, this deposit should be looked upon as a curving continuation of it, along with the white quartzite of that deposit. This mine is at the relatively high altitude of 103 meters and is 70 meters above the surface pf the paddy fields. The iron-ore boulders extend from the south side to the summit and run down the opposite side some 70 meters, for a total of 400 meters - an excellent range, though there is very little below 70 meters.

Amount of Ore

Length Width Depth

400m x 100m x 1.5m x 0.4 tons = 24,000 tons

As in the case of the Van Cu No. 4 deposit, this deposit lies between two lines of quartzite strata on a strike of N60°W, lying in almost a straight line.

Dan Trai No. 2 Deposit - Here the ore rocks are accumulated on the slopes near the summit of an unnamed hill 124 meters high, on the right shore of the Ngan Truoi River. The dimensions are 30 meters up and down and 20 meters sideways. There are boulders from several tens of tons down to 20 to 30 centimeters in diameter. The rock that forms this region is

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phyllite, clay-slate and quartzite, with a strike of N55-70°W and a gradient to the east of 50° to 70°.

Amountoof Ore

Vertically		Horizontally		Depth		
30m	x	20m	x	1m	x0.5 tons =	300 tons

The amount of ore is 300 tons. And, if the large boulders are included it would total over 500 tons.

Grade of the Ore:

No.	C.W.	Fe	SiO_2	Mn	Al_2O_3	CaO	MgO	S	P	Notes
5919	11.97	56.81	1.90	0.26	2.07	—	Tr	0.070	0.424	

(Assay by Japan Steel Pipe Co., Ltd., 1942)

5. The Da Bac Region

This region includes three deposits on the right shore - or south shore - of the Ngan Truoi River.

Da Bac No. 1 Deposit - On the shore opposite the Van Cu NO. 2 deposit, or the right shore (Dory Dat) of the Ngan Truoi River, this deposit is removed from the river some 500 meters. It is 20 meters above the surface of the paddy fields on a hill and measures only 75meters by 30 meters, though the grade is comparatively good.

Amount of Ore

Length		Width		Depth		
75m	x	30m	x	1.0m	x 0.3 tons =	675 tons

As the area of distribution is small, the amount of ore is only 675 tons.

Da Bac No. 2 Deposit - On the right shore (Bao Deng) of the Ngan Truoi River. This vicinity is made up of strata of black clay-slate, phyllite and quartzite. These run N75°W and have a gradient to the northeast of 70°. At the foot of the hill at a height of about ten meters from the valley floor are large limonite boulders, some fifteen to sixteen in number. The largest are about 100 tons; and they amount to roughly 500 tons altogether. These, with the already mined ore of 500 tons, total more than 1,000 tons.

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Da Bac No. 3 Deposit - On the right shore (Da Bac) of the Ngan Truoi River, this deposit is divided between two sites, A and B.

A: The matrix rock is gray clay-slate running N70°W. The ore deposit is 35 meters by 7 meters in size, on the northwest slope and is composed of scattered ore rocks large and small. The amount of ore is estimated at about 200 tons, and the grade is comparatively good.

B: Located over 500 meters east of the former, on an easterly slope. The dimensions are 30 meters by 7 meters, within which are piles of large boulders. But, across the peak there are no ore rocks to be seen. Here the ore is found only on the surface of the ground; none occurs underground.

In the small valley running along the east side of this hill there are relatively large numbers of ore rocks under 50 centimeters in diameter, and extending for about 200 meters. Totalling together the above two deposits, we find the amount of ore to be around 1,000 tons. The boulder ore accumulated on the slopes not only occupies an extremely limited area, but also in the bed of the valley there are ore rocks scattered. However, we do not know whether there are any ore deposits besides these. It would be necessary to clear the trees an open up the area in order to conduct a full survey. And, in this region between Bao Deng and Da Bac are some sites where ore is scattered. To open these up for mining would enable some increase in the amount of ore produced.

The Grade of the Ore:

No.	O.W	Fe	SiO_2	Mn	Al_2O_3	CaO	MgO	S	P	Notes
5923	11.13	54.12	2.80	1.52	1.88	—	Tr	0.028	1.434	No. - Ore Deposit
5924	10.17	57.11	3.04	0.06	1.69	—	"	0.052	0.824	No. = Ore Deposit
5911	9.52	54.90	9.48	0.05	1.14	—	0.09	0.010	0.561	Bao Deng

(Assay by Japan Steel Pipe Co., Ltd., 1942)

6. The Khe Truoi Region

In this region, too, there are three ore deposits. Coming from the west of the Ngan Truoi River and turning sharply south from the northwest is the tributary Hoi Truoi River, which meets the Ngan Truoi. Beginning from a location about three kilometers to the northwest and extending for one kilometer are the three deposits.

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Khe Truoi No. 1 Deposit - At the roadside ore rocks can be seen scattered about; and at the same time white quartzite rocks are seen on the other side. Further, there is a hill about 17 to 18 meters above the surface of the valley; at its summit is a shrine. The ore rock is distributed from northwest to southeast for 150 meters, this extending for a width of 50 meters.

Amount of Ore

Length	Width	Depth		
150m x	50m	x 1.0m	x 0.2 tons	= 1,500 tons

The usual ore rock is around 30 centimeters; larger ones are not to be seen. Here, where there are an estimated 1,500 tons of ore, there are two lines of white quartzite on each side of the ore body.

Khe Truoi No. 2 Deposit - This is about 600 meters northwest of the previous one and is on an elliptical hill 75 meters high. On one side the vegetation grows thickly, and across the summit on the northwest side are scattered ore rocks of less than 50 to 60 centimeter in size. On this slope the dimensions of the deposit are 120 meters by 100 meters.

Amount of Ore

Length	Width	Depth		
120m	x 100m	x 1.0m	x 0.3 tons	= 3,600 tons

The amount of ore is seen to be about 3,600 tons.

Khe Truoi No. 3 Deposit - The deposit is on a 50-meter hill neighboring on the previous deposits, being separated from them by a small valley which is filled with water in the form of whirlpools. The ore deposit is a continuation of the above ones and is accumulated on the northeast part of the hill, running to the northwest. Its dimensions are 170 meters by 55 meters, and the amount of ore is estimated at 2,800 to 3,000 tons.

Amount of Ore

Length	Width	Depth		
170m x	55m	x 1.0m	x 0.3 tons	= 2,805 tons

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The Grade of the Ore:

No.	C.W.	Fe	SiO_2	Mn	Al_2O_3	CaO	MgO	S	P.	Notes
5915	10.71	52.27	6.92	0.15	4.03	—	tr	0.020	1.010	No. 1 Ore Deposit
5916	11.30	53.28	4.04	0.13	2.05	[illegible]	[illegible]	0.020	1.156	No. 2 Ore Deposit
5917	11.14	54.70	3.82	0.27	1.82	[illegible]	[illegible]	0.045	0.634	No. 3 Ore Deposit

(Assay by Japan Steel Pipe Co., Ltd., 1942).

7. The Trang Sim Region

This region, located three kilometers northwest of the Khe Truoi region, also has three deposits.

Trang Sim No. 1 Deposit - Going north along a tributary of the Khe Truoi River is a hill (73 meters) on the west side between a cultivated area and an unnamed hill 109 meters above sea level. The ore rocks are distributed over the whole of the east side. The large ore rocks are on the northwest edge of the region, some of them reaching 50 to 60 tons; but the ordinary ones are mainly from 20-30 centimeters to 50-60 centimeters in size.

Amount of Ore

Length Width Depth

250m x 100m x 1m x 0.2 tons = 5,000 tons

Actually, the amount of ore should be regarded as a maximum of 4,000 tons.

Trang Sim No. 2 Deposit - The ore rocks, which are distributed for a long distance on the northeast flank of the unnamed 109-meter hill, include no very large ones - most of them being 50 centimeter to one meter in diameter and comparatively rich. The dimensions of the deposit are 370 meters by 75 meters, and the grade is good.

Amount of Ore

The amount of ore is believed to be roughly 11,000 to 13,000 tons.

Length Width Depth

370m x 75m x 1.0m x 0.4 tons = 11,100 tons

Trang Sim No. 3 Deposit - Separated from the above by a small valley of some 100 meters width. And, it is on a line with the above deposit; yet it is only 100 meters by 60 meters in size, with large and small ore rocks of comparatively poor grade.

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Amount of Ore

Length Width Depth

100m x 60m x 1.0m x 0.2 tons = 1,200 tons

The amount of ore is believed to be under 1,200 tons.

Grade of the Ore:

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MO.	C.W.	FE	SIO_2	MN	AL_2O_3	CAO	MGO	S	P	NOTES
5914	10.40	52.51	7.04	OA2	4.38	-	0.10	0.049	0.526	NO. 1 ORE DEPOSIT
5912	10.42	56.22	2.50	OL09	2.73	-		0.073	0.863	NO. 2 ORE DEPOSIT
5913	10.52	52.39	7.94	0.78	2.34	-	0.08	0.014	0.951	NO. 2 ORE DEPOSIT

(Assay by Japan Steel Pipe Co., Ltd., 1942)

These ore deposits of the Song Ca tributary region are all of about the same character and distance from the river banks, so that mining them and shipping their ore would be under almost the same conditions. Thus, with the average distance from the river being taken as two kilometers, we will compute the mining and shipping costs.

Mining Costs

Daily production	100 tons
Daily wage for mining 0.5 tons - $0.50 silver (Open-cut digging by hand hand, rarely employing blasting)	$1.00/ton
Explosives	0.05
Earth excavation	0.08
Workers' wages	0.06
Miscellaneous	0.05
Supervsison (Annamese)	0.03
Total	$1.27/hour

Ore Grading

Sorting at each working face and storage in the immediate vicinity would be the rule.

Ore sorters - 4T/worker/day with $0.45 in wages	0.11
COST AT THE MINE	$1.38 per ton

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No.	O.W.	Fe	SiO_2	Mn	Al_2O_3	CaO	MgO	S	P	Notes
5914	10.40	52.51	7.04	0.12	4.38	—	0.10	0.049	0.526	OABAN No. 1 Ore Deposit
5912	10.42	56.22	2.50	0.09	2.73	—	[illegible]	0.073	0.863	No. 2 Ore Deposit
5913	10.52	52.39	7.94	0.78	2.34	—	0.08	0.014	0.951	No. 2 Ore Deposit

Shipping Costs

Using 1-ton cars on 12-pound [sic - Japanese phonetics] rails for two kilometers, fifteen owrkers, each making seven round trips daily, would be required.

Wage/worker/day	0.50	$0.07/ton
Loading at the mine		0.07
Unloading at the river		0.07
Rail maintenance, oil, etc.		0.03
Supervision (Annamese)		0.03
	Sub-total	$0.27/ton

Cost of River Shipping

From the center of the region to the storage depot at the river mouth - Hai Yen - the distance by water is 77 kilometers. The 27 kilometers to An Phu would be by 5-ton lighter. Below An Phu 50-ton lighters would be used for the 50-kilometer trip to the depot.

According to Mr. Yokoyama's experience:

River bank to storage depot (Hai Yen)		$3.00/ton
Storage and loading		0.30
	Sub-total	$3.30

TOTAL OF ABOVE - BASE COST TO STORAGE DEPOT: $4.95/ton

Conclusions:

The above is the nucleus of the Song Ca and Ngan Truoi River and the two tributaries. These are divided into seven convenient regions of ore deposits, lined up like the links of a chain on both sides. These are iron-ore deposits belonging to the same zone. The surveyed ore deposits of the Song Ca main-course region all contain manganese, but in the tributary region there is not a bit of it. These have in common their origin, their communicationa and the shipping from the river bank, using the rivers. Furthermore, all are surface deposits, and their scale is not large. The overall total amount of ore is about 90,000 tons; but each one individually has but poor industrial value. Still this suggests starting work on all at once, cleaning them up ay one sweep. And, developing them would not require large-scale preparations - just 6-ton rails and hand-push carts sufficing. However, considering the costs of earthworks as against the amount of ore, we conclude that ore cars cannot be used. And, if the ore production were 100 to 120 tons per day the carting could be handled by native push-carts. (One cart moves 40 tons at a time [sic]). We feel that this region could most suitably turn out an annual production of 30,000 to 36,000 tons. And, although we have dealt here only with those areas already discovered, these being the ones surveyed this time, there is the possibility of new ore deposits being discovered in this zone, in which case the amount of ore would increase, and the ore production could be upped somewhat. The season when the loading of the depot ships in the offing of the Vinh area seacoast is the six months from April to September. The ore would all be stored at Hai Yen at the mouth of the Song Ca. The lighters would have to be loaded during this season - 100-ton lighters being suitable for the job. The plan for setting up a supplemental storage point on Hon Nyu [phonetic approx.] Island deserves considerable study.

3. The Van Trinh Concession

Location and Transportation:

This is about 27 kilometers north of Vinh in Annam State. Thirty minutes' driving northward along Colonial Highway No. 1, paralleling the railroad line to Hanoi, brings one to Den Ne village. One crosses the Ken Sal canal, which connects with the river, and walks southwest for two kilometers to reach the mine. To haul the ore, there is one car for the two kilometers from the mine to the above-noted Ken Sal canal. From here the ore would go by river vessel for 7 kilometers on the canal and about 10 kilometers down the Kua Ro [phonetic approx.] River to the river mouth. Thus, shipping the ore would be convenient. However, as the channels of the canal and the associated river are not deep, 5-ton to 15-ton lighters would have to be used.

The Concession and its Area

No. of Concessions	1 concession
Name of concession	Van Trinh Area: 351 hectares
Date registered	January 5, 1940
Holder of Mining rights	Phut-Thanh et Nha, Vinh

Operators	Same
Agent for the Ore	Sanko Company, Ltd.

History:

The holders of the mining rights formed the company in 1938, and in 1940 employed 500 coolies; during one month they mined 5,000 tons of raw ore. They are said to have sold 3,000 tons of refined ore to Japan Steel's Hachiman Foundry.

Terrain:

Located on the east side of Ru Thanh Va (441 meters) where the map shows an unnamed 297-meter hill that has the shape of a capital "I". The ore deposit occurs below 140 meters on the northwest slope of a psur on the north side. The valley separating this ore deposit and the west side of Ru Thanh Va runs north into the previously noted Ken Sal canal, which in turn runs east-southeast along the north side of Ru Thanh Va. This canal was built by making improvements on a tributary of the Kua Ro River [phonetic approx.] which winds eastward from far to the west, gathering in numerous tributaries that flow from the south side of this mountain range. It flows north past the east side of this ore deposit, and there the channel turns southeast, and the river flows on down to the sea.

Geology and the Ore Deposit:

According to the survey by the French Indo-China Mining Bureau, the rocks forming this vicinity are clay-slate and quartzite of the Carboniferous period of the Palaeozoic era. And, the sandstone and shale which lie to the north and south on each side of it belong to the Retien system of the Mesozoic. The strike is N70°W, and the gradient is to the northeast by about 60°. The ore deposit is limonite permeating into the clay-slate; and part of it contains manganese. On the surface of the ground at or near the ridge line are a number of irregularly shaped ore boulders two to three meters in diameter. Besides these, there is only to be seen a rough scattering of generally small ore rocks on the slope. In the mined terraces at the foot of the hill the depth of the ore deposit is 1 to 2 meters, and it shows its accommodation to the strike and gradient of the strata. Other than this, there is almost no ore on the steep slopes. On the gentler slopes

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where the surface strata are broken and piled up there are fairly rich accumulations of ore fragments, with a depth down three meters, and sometimes six meters. Occasionally fresh hematite breccia is to be seem on the surface. This contains a comparatively large amount of silicate. The originally formed ore was hematite which metamorphosed into this. The ore occurs on a slope about 200 meters by 300 meters, or 60,000 square meters.

The Kinds and Amount of Ore:

The ore is limonite, and limonite containing manganese. The grade is as shown in the table; and when sorted, the iron content can be brought to 52-53%. The wolframite ore is 35-40% iron and 15-20% manganese. The manganese ore os 40-45% manganese. In each ore the silicate is less than 10%.

The Grade of the Ore:

No.	O.W.	Fe	SiO_2	Mn	Al_2O_3	CaO	MgO	S	P	Notes
5903	9.09	37.56	19.00	5.00	6.49	—	0.25	0.044	0.372	Accumulated fragments above foot of hill
5704	8.90	36.24	9.78	12.12	6.17	—	0.24	0.034	0.087	Average sample from mining terrace
5905	9.89	48.21	6.80	4.26	8.57	—	0.19	0.035	0.152	Ore fragments [illegible] rock slide on hill flank
5945	8.31	45.66	10.38	4.57	5.69	—	0.14	0.058	0.048	
5946	7.87	32.71	17.22	6.36	11.01	—	0.28	0.029	0.097	
5947	9.05	46.44	5.98	8.03	3.92	—	0.15	0.042	0.146	

(Assay by Japan Steel Pipe Co., Ltd., 1942)

Horizontal	Slope	Depth		Safety Factor		
200m	x 300m	x 2m	x 0.4 tons	x 0.7	=	33,600 tons
Other accumulations of ore					=	200 tons
Stored ore (raw ore) 1,079 x 60% (grading %)					=	647 tons
				TOTAL		34,447 tons
						or
						34,500 tons

In the above ore, 150 tons of manganese ore and 500 tons of wolframite can be sorted out. The ore already mined here and in storage at the mine amounts to 847 tons, and in storage at the Kua Ro [phonetic approx.] storage depot, about 2,476 tons - a total of 3,323 tons in storage. 3,000 tons have already been exported, so that the grnad total is 6,323 tons.

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Mining Methods:

As noted in the paragraph on the ore deposit, there are ore rocks scattered over tne surface, and so-called outcropping ore deposits which shallowly penetrate the bedding planes of the rock. Thus, from the goot of the hill up to 300 meters the mining would be by the terrace method; and at appropriate places inclines or chutes would be installed for getting the ore down. Other types of installations would be unnecessary. The mining would be easier than at Yen Cu and the costs would be 1.20, including the cost of explosives, mine supervision, tools and other expenses.

As the grading of the ore would be relatively simple, the per-ton cost would be 1.00; and excavation of the earth, 0.50: total - 1.50.

Transporting the Ore:

Transportation from the mine to the canal would depend on native carts. To meet the mine's daily production of 50 tons, 210 carts would be used. Each would ,ake six round trips daily. River shipment would be over the 17 kilometers to the river mouth, and then 16 kilometers from there to Hai Yen storage depot. The total cost of loading, shipping and unloading would be 0.90 per ton.

So, the base price per ton from the mine to the Hai Yen depot would amount to the totals of the above costs from the mine to the Hai Yen depot: 5.68.

Cost of Loading onto the Depot Ships:

The seacoast in the Vinh area enables ships to be loaded only during the season from April to September because of the wind and waves - a point which always gives headaches to the people of the mining industry. It is a major drawback. In the past, too, this kind of seasonal change made it impossihle to load the depot ships; and we were told that in loading 8,000 tons of ore ¥24,000 was paid just to keep the ship at anchor, However, in the quiet periods a maximum of 1,200 tons and a minimum of 700 tons of ore can be loaded per day - which can be considered to average 800 tons. The depot ships anchor in the offing 25 kilometers from the Hai Yen depot; the loading costs are summarized below.

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Calling the monthly production 5,000 tons (by the survey of the Sanko Company, Ltd), estimates are given per ton:

Coolies' wage - depot to lighter (17-ton burden)		0.90
Wage of lighter coolies		0.14
Loading supervision (including staff resident at Vinh)		0.10
Winch man		0.06
Basket fee		0.15
Coolies on ship board		0.02
Rope fee		0.06
Electricity and phones		0.02
Lighter anchoring		0.02
Extra coolie crew on lighter		0.10
Taxes, etc.		1.20
	Total	2.70

Previously, these costs were 1.20 to 1.70, but because of the recent rise in the cost of goods and wages, we were told that the above expenditures would be necessary.

Base costs - mine to depot ship: As stated above, the base cost to the Hai Yen storage depot is 5.68. Added to this is the base cost of 2.77 from the storage depot to the depot ship - a total of $8.45.

Conclusions:

In this region the arrangements for each ore deposit would be comparatively good. Not only are the mine costs and the shipping costs both rather low, but also it is a location convenient for storage of ore at the Song Ca mouth and for loading the depot ships at the same time with the ore from the tributary region of this same river, thus enabling the development of the Song Ca tributary region for the production of ore.

4. The Dong Ken Region

The Chan Tien and Dong Ken Regions

Location and Communications:

Dong Ken is southeast of Vinh some 27 kilometers at a coastal fishing village that can be reached by car, the trip taking one hour because of

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the ferrying point along the way. Also, for the last 4 kilometers there is no road, and one must go along the sandy beach so that in stormy weather or at high tide it is impossible to pass by. The ore deposit is on Mt. Ham Son (154 meters), which is close by the Song Ken mouth near to Dong Ken village. So, for hauling out the ore, oxcarts or wheel barrows [literally, "one-wheeled vehicles"] would haul it the 4 or 5 kilometers to the seacoast; and then it would be loaded into lighters in the offing.

The Concession and its Area:

The concession constitutes two mining areas -

1 Chan Tien concession	396 hectares
2 Dong Ken "perimeter"	4.5 square kilometers
Date of permit for Chan Tien	January 5, 1940
Holders of mining rights	1.Nguyen Xuan-My Vinh 2.Phuc-Thanh et Nha Vinh
Actual operators	Same
Ore agents	Mr. Shoshu Yokoyama, for Nguyen Xuan-My's share The Sanko Company, Ltd., for Phuc-Thanh et Nha's share

Topography:

Mt. Ham Son is a spur on the east side of the Nui Ong mountain group. Its elevation is 154 meters, and its southeastern end abuts directly on the sea. On the east side a sand spit has formed between the mountain and the Song Ken because of the action of the northeast wind. The west side is separated from the main mountain mass by a wide valley running southward. The whole surface of this gently sloping valley is under cultivation.

Geology and the Ore Deposit:

The geology here is made up of shale and sandstone strata belonging to the Carboniferous period of the Palaeozoic era. Shale predominates. The strike is N60°W and the gradient, 40° to the west.

Between the east side of Mt. Ham Son and the southern part is black biotite granite. In this granite section, conifers form flourishing woods. And, between this and the strata of sandstone and shale where the ore

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deposit occurs there is a small ravine where the boundaries of both kinds of rock are clearly seen. The ore deposit can be described in orderly sequence starting with that part on the east side, as follows.

No. 1 Ore Deposit

This occurs on both ends of the east side of Mt. Ham Son in a zone of shale which is demarcated from the granite area by a small ravine running eastward. It is a deposit of iron ore and wolframite which have permeated into the shale and sandstone; i.e., it is a surface ore deposit formed secondarily. Considering the abutting granite, it should be a hematite and magnetite ore deposit formed as a contact or metasomatose ore deposit in the vicinity of the points of contact between the iron-bearing solution from these rocks and the sedimontary rocks.

South from the traces of previous mining is a one-meter wide band of permeation-form limonite; this should be mineable up to about 20 or 30 tons. And, 20 tons of iron ore and over one toneof manganese ore are stored here.

No. 2 Ore Deposit

This ranges from both ends of the mountain summit to the slopes on the west side. In the summit area there is poor iron ore of a grade of 30 to 40% iron. But, slightly lower down the grade improves a little; and, if sorted, it could run over 50%. The largest site of mine diggings is 40 meters long by 10 meters wide at its widest point, and 7 meters deep. In addition, there may be seen in several locations mine diggings 10 meters long, 7 meters wide and about 7 meters deep, in the shape of pots. Several meters up from the foot of the mountain there is a deposit chiefly iron ore, but also containing manganese. Thus, on the whole this region in the mountain summit sector is poor iron ore and shale and sandstone containing iron, not worthy of consideration from an economic viewpoint.

Next is the rather good limonite ore on the side of the mountain, raning over an area 200 meters by 50 meters. Part of this would warrant mining as iron ore.

Finally, there is wolframite ore at the foot of the mountain in an area 50 meters wide. Part of it is wolframite and part is manganese ore, and it would have to be sorted out.

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The Amount of Remaining Ore: Length Width Ore Portion Depth Rate

Length	Width	Ore Portion	Depth	Sorting	Sorting Rate	
200 x	50 x	1/5	x 1.0	x 4 tons	x 0.5	= 4,000 tons iron ore
200 x	50 x	1/20	x 1.0	x 4 tons	x 0.5	= 1,000 tons wolframite

This 1,000 tons breaks down as 200 tons of manganese ore and 800 tons of wolframite.

Ore in Storage:

Iron ore -

4 x 2.5 x.51 x 2T = 20
5 x 4 x 1 x 2T = 40
1^3 x 2T = 2
5 x 10 x 1 x 2 = 100
1.5 x 2 x 1 x 2 = 6
2 x 0.5 x 0.7 = 1.4
5 x 4 x 1 x 2 = 40
10 x 3 x 1 x 2 = 60
1^3 x 2 x 1 x 2 = 4
4 x 2 x 1 x 2 = 16
1 x 2 x 2 = 4
3 x 6 x 0.5 x 2 = 18

$4m^3$ x 2 = 8
2 x 4 x 1 x 2 = 16
6 x 5 x 1 x 2 = 60
4 x 3 x 0.7 x 2 = 16
7 x 4.5 x 1 x 2 = 63
6 x 3 x 1 x 2 = 36
5 x 5 x 1 x 2 = 50
3.5 x 5 x 1 x 2 = 35

Total 564.7 x 8 (sorting rate) = 451,76 tons (refined ore)

Wolframite ore -

6 x 3 x 1.2 x 2T = 0.24
6 x 6 x 1 x 2 = 72
4 x 1 x 2 x 2 = 16
7 x 4.5 x 1 x 2 = 63

1.0 x 2 = 2
4 x 1.5 x 0.8 x 2 = 96
4 x 2 x 7 x 2 = 16
4 x 2 = 8

Total 187 x 0.8 = 149.6, or 150 tons (refined ore)

Manganese Ore

4 x 1.5 x 0.7 x 2 = 8.4
2 x 2 x 1 x 2 = 8
2 x 2 x 0.4 x 2 = 3.2
$4m^3$ x 2 = 8
$4m^3$ x 2 = 8

2 x 2 x 6 x 2 = 4.8
6 x 1.5 x 8 x 2 = 14.4
1 x 1 x 0.8 x 2 = 1.6
$4m^3$ x 2 = 8
$2m^3$ x 2 = 4

Total 108.9 x 0.9 = 98 tons (refined ore)

[Translator has not attempted to correct the text's errors in the above computations.]

Therefore:		
	Iron ore	451 tons
	Wolframite ore	150 tons
	Manganese ore	plus 98 tons
	Total	699 tons

No. 3 Ore Deposit

At the side of the road at the north end of the previous deposit is a deposit of wolframite covering a small area. There are traces of digging measuring 30 meters by 10 meters at the widest by $2\frac{1}{2}$ meters deep. All of the ore dug from here is in storage. The matrix rock was clearly quartzite.

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But, this being a low-lying site, there is no place for measuring the strike or the gradient.

Ore in Storage:

Iron ore -
4 x 3 x 1 x 2T = 24
0.5m³ x 2 = 1
3 x 2 x 0.3 x 2 x 0.9(sorting rt) = 3.24
3 x 2 x 0.5 x 2T = 6
0.3 x 2 x 1 x 2 x 0.9(sorting rate) = 10.8
3 x 2 x 1 x 2 x 0.85 = 10.2

Total 55.24 = 55 tons (refined ore)

Wolframite ore
4 x 2 = 8
4 x 2 = 2 = 8
5 x 3 x 0.5 x 2 = 15
4 x 4 x 0.8 x 2 = 25.6
2 x 2 x 0.5 x 2 = 4
1 x 1 x 0.5 x 2 = 1
2 x 2 x 1 x 2 = 8
3 x 2 x 0.9 x22 Sorting x 0.7 = 7.6
2 x 1 x 0.5 x 2 = 2
3 x 2 x 1 x 2 x 0.5 = 6
1.5 x 1.5 x 0.5 x 2 = 2.25
4 x 2.5 x 1 x 2 x 0.6 = 18
4 x 4 x 1 x 2 x 0.9 = 28.8

Total about 134 tons (refined ore)

Manganese ore
5 x 2 x 1 x 2 = 20
3 x 2 x 0.8 x 2 x 0.5 = 9.6
3.5 x 2 x 1 x 2 = 14
2 x 1.5 x 0.5 x 2 = 3
1 x 1 x 0.5 x 2 = 1
3 x 2 x 0.9 x 2 = 10.8

Total about 58 tons (refined ore)

Total of the above: 58 & 134 & 55 = 247 tons

The amount of ore remaining can probably be deduced from this amount of mined ore and the previous amount.

No. 4 Ore Deposit

At a spot 150 meters north of the previous deposit there is limonite ore which has metasomatosed from quartzite, but it is of poor grade. Nevertheless, some 400 tons of iron ore could probably be obtained.

100 x 200 x 1 x 0.2 = 400 tons

No. 5 Ore Deposit

This is an ore deposit at the northernmost limit of this region; it is in the Dong Ken concessions. The ore is limonite, and it occurs on a round hillock rising 15 meters above the nearby paddy fields. The loose rock on the surface covers an area measuring 150 meters by 100 meters; and it reaches to the summit of the hill. This is an example of outcropping, with ore that is quartzite permeated with limonite. The geology of this vicinity is made up of the quartzite, phyllite and slate. The strike is N30°W, and the gradient is 70° to the west.

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Amount of Ore:

As this is a deposit as yet totally unmined and without any prospecting pits, the amount of ore can only be computed sketchily from what is already known of this kind of deposit in the Song Ca tributary region.

Length Width Depth

150m x 100m x 1.5 x 0.5 = 11,250

Ore in storage at the mine:

Iron ore - $4m^3$ x 2 x 1 = 8
5 x 3 x 1 x 2 x 1 = 25.5
8 x 3 x 1 x 2 x 4 = 16.3

Ore in storage at the seacoast:

Iron ore - 6m x 2 x 2 = 21.6
8 x 4 x 1 x 2 x 3 x 0.3 = 153.6
8 x 2.5 x 0.9 x 2 x 1 = 36
4 x 3 x 1 x 2 x 1 x 0.85 = 20.4
2 x 2 x 0.9 = 3.6

Total 432 tons (refined ore)

Grade and Kinds of Ore:

Iron ore 52 - 53%

Wolframite ore 30 - 40% Fe 10 - 20% Mn

Manganese ore 40 - 45%

These then are limonite ore, and hard and soft manganese ore.

Grade of ore:

No.	C.W.	Fe	SiO_2	Mn	Al_2O_3	CaO	MgO	S	P	Notes
5906	11.14	48.45	3.32	5.91	2.31	—	0.13	0.058	1.596	Iron ore stored at No. 3 Ore deposit
5907		21.89	4.28	20.42	1.75	—	0.07	0.006	0.873	Wolframite - same location
5908	—	18.42	1.64	24.66	2.71	—	0.03	0.016	0.658	
5977	10.09	59.45	2.68	0.16	0.97	—	0.05	0.021	0.600	Iron ore at No. 5 Deposit
5972	7.26	29.83	3.04	26.25	3.63	—	tr	0.060	0.602	

(Assay by Japan Steel Pipe Co., Ltd., 1942)

Costs from mine to depot-ship loading:

As the mining would be open-cut digging, and as the grade of the ore is very uneven, the policy would be to dig selectively and not to install any separate [distinctive to this mine only] equipment. Mining costs would run to $2.00 per ton. The ore grading would be by hand sorting at the mine, this costing $2.00 per ton. As the land transportation would only be over a distance of 2 to 5 kilometers, wheel barrows would be used. If each of the two concessions had a daily production of 50 tons, the average cost per ton to transport the ore to the storage depot on the seacoast

(In the case of the Dong Ken concession, to the river-side storage depot.) would be $2.50. The costs of supervision, tools and explosives would be $0.57. Add to this $0.20 for earth excavation, and the base costefrom the mine to the river-side oreseacoast storage depot would be $5.27.

The depot ships would anchor two kilometers out from the shore. Loading of the depot ship would be the same as in the case of the Hai Yen depot. The cost is 2.77, so that the Dong Ken base cost F.O.B. the offing would be $8.04. [The text through this section uses the $ sign.]

Conclusions:

The Chan Tien concession, close by the seacoast, requires no water shipment, while the Dong Ken concession would require just one kilometer of river shipment, since both are hard by the sea shore and are convenient to the offing. Yet, the loading of the depot ships is the same as loading in the offing from the mouth of the Song Ca. For loading on the open sea, thought must be given to the type of weather and the amount of ore in storage at the Song Ca mouth from April through September, choosing times of favorable weather. Since it would be difficult to assign ships for the sole use of the ore production of this region, they would have to be for alternate use in every part of the Vinh region.

5. The Thanh Da Den Concession

Location and Communications:

This is the Thanh Da Den concession about 40 kilometers south of Vinh. One drives down Colonial Highway No. 1 for about 25 kilometers and then proceeds for 8 kilometers along the village road. At Dong Son village one leaves the auto behind and walks over 8 kilometers to the concession.

Or, going instead by Colonial Highway No. 8, one passes through the ferrying point at Khanh Son and proceeds to Cao Nho by auto. There one need only walk a distance of 5 kilometers. Thus, communications to Vinh from here are not necessarily inconvenient. For hauling out the ore, rafts (1-ton capacity) would be used from the concession for about 7 kilometers to Nga Khe. Then, 500-ton lighters would be used down the Cau Cay Su River to Dong My, coming here into the main course of the Song Nghan and proceeding thence to the river mouth, this distance being 48 kilometers. The total distance is 55 kilometers and is rather inconvenient.

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Concession Name	Thanh Da Den No. 1 Concession
Registry Number	None (Prospecting Application in process)
Holder of mining rights	Nguyen Xuan My, Vinh

Terrain:

The concession is located east of the Gang Sou River where the Mts. Truong Ba (300 meters) and Truong Xay (230 meters) stand in a row. The streams arising from the west become the Gang Sou River, and those flowing down the east slopes become the Cau Cay Su River. To the northeast, they thread through the hilly area until they finally reach the distant alluvial plane. The ore deposit is in a hilly area at the north foot of Mt. Truong Xay.

Geology and the Ore Deposit:

The rocks forming the region belong to the Carboniferous period of the Palaeozoic era, and are clay-slate and quartzite. At the approach to the concession, the eastern part, there are outcroppings of sandstone and quartzite of the Jurassic period of the Mesozoic era. The strata run N50°W and slope 60° to 70° to the west. The ore deposit is made up of numerous loose rocks scattered on the surface along a northwest to southeast axis and over a range about 200 meters by 70 meters. Its northwest edge includes accumulations of boulders about 3 meters in diameter. In addition, there are medium-sized rocks about 30cm to 1m in diameter. The western half is mostly limonite, while the eastern half includes many manganese-ore rocks. This ore deposit belongs to the category of so-called exposed, remnant ore deposits.

The Ore and its Grade:

Here there are two kinds of ore: limonite and manganese-bearing limonite. The grade of the iron ore is 51 to 52%. That of the wolframite is 35 to 40% iron and 7 to 16% manganese. And, the manganese ore's grade is 49%.

The Grade of the Ore:

No.	C.W.	Fe	SiO_2	Mn	Al_2O_3	CaO	MgO	S	P	Notes
5932	10.81	56.10	4.06	1.30	1.06	—	tr	tr	0.595	Iron ore - average sample for this ore deposit
5933	—	33.56	2.19	20.30	2.01	—	tr	tr	0.566	Manganese ore

(Assay by Japan Steel Pipe Co., Ltd., 1942)

Amount of Ore:

Length Width Depth

200m x 70m x 1m x 0.18tons = 2,500 tons (plus or minus)

To compute the amount of ore, it is necessary to dig test pits and see the conditions down to the bottom. Without doing this, there can be no assurance of the accuracy of the estimate. But, this time we had no time for this, so that we merely dug down 1 meter and estimated the content of ore rock - deriving therefrom 0.18 tons/cubic meter. Thus, there are about 2,500 tons.

When the above ore is sorted, the following proportions must be computed:

2,500 x 0.5 = 1,250 iron ore

2,500 x 0.3 = 750 tons wolframite

2,500 x 0.2 = 500 tons manganese ore

Mining:

The mining would be by the open-cut method, occasionally employing explosives. The following costs are based on a daily production of 10 tons.

Mining costs	1.50 piasters
Tools and other expendables	0.50
Total	2.00
Ore transporting	1.50
Earth excavation	0.50
Total	2.00
Supervision, etc.	0.50
Total base cost at mine	4.50

~~Shipping~~tation

From the mine(Nga Khe) by raft for 1 kilometer -

Crew of 2 x 0.50 = 1.00 1.00/ton

43 km by 5-ton lighter -

Crew of 3 x 0.50 x 4 days = 6.00 -- 1.00/ton

Loading and unloading rafts	0.60
Loading and unloading lighters	0.60
Total	3.40

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Conclusions:

With costs from the mine to the river mouth computed roughly as above, they easily allow development. But, in view of the small amount of ore - 10 tons per day for 10 to 12 months - development could only be considered if carried out in conjunction with the other areas.

B. THE TAN NOIR REGION

Section 1 Forward

In the region of Tan Noir Province, Annam State, there is a deposit of hematite ore and three or four deposits of limonite; but this time our goal was to go there and carry out a survey of the most famous concession - Bulu - in Bai Xim. There we heard for the first time that there is iron ore at Bong Hang in this vicinity. We barely had time to go there and devote a single day to surveying it.

Section 2 Discussion

Tan Noir is the second city of Annam, after Vinh. There are two or three known ore deposits, with this as the center; but except for the Bulu concession, the others are of poor grade and have no present value. This time we surveyed the two concessions of Bai Xim and Bong Hang.

(1) The Bulu Concession of Bai Xim

The Bulu concession, about 50 kilometers south of Tan Noir, is reached by auto. The ore deposit is below the middel flank of a hill rising some 50 meters above the surface of the Bulu river; and it is a hematite deposit - an accumulation of boulders and stone on top of Palaeozoic slate. Its main body has not yet been discovered. The surface of the ground is hidden by woods, making the survey difficult.

The amount of ore is estimated at about 90,000 tons; and the grade is good, containing 63% iron and only 4 - 7% quartzite.

Shipping would be by 2-ton lighters, going 12 kilometers down the river that runs below the mine, to the small storage depot. From there on down, 15-ton lighters would be used. Ore production would probably be 100 tons

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daily and 2,000 tons monthly.

The river mouth is open to passage on out to sea, but it is not convenient for anchorage of steamships for loading the ore. However, for half the year - from April to September - if the sea is calm the ore can be picked up from storage at the river mouth and taken to the ships in the offing.

The base cost at the mine would be 2.70 piasters. Transportation costs on land of 0.25 piasters, and by water of 2.45 piasters would total 2.70 piasters. So, the overall total base cost to the river mouth would be 5.40 piasters.

While these computations are based on the presently known amount of ore, prospecting for ore still goes on at the same time. If the main ore deposit is discovered, the necessary facilities for exploiting this should be set up as quickly as conditions would permit.

(2) Bong Hang Concession

This concession is at Bong Hang village, 38 kilometers north of Tan Noir. The ore is a limonite permeation of Palaeozoic clay-slate; and its grade does not reach 50%, meaning that there is no present value in developing it.

Section 3 Discussion of the Ore Deposits

(1) The Bulu Concession of Bai Xim

Location and Communications - This concession is at Bai Xim village, Tan Noir Province, Annam State. It is about 50 kilometers south of Tan Noir, capital city of the province, and 13 kilometers southwest of Thi Long station on the Hanoi-Saigon railway. The vicinity of this concession is given over to tea and coffee plantations; and though it is located on an undulating highland, it can be reached by auto, so that its location is convenient for transportation.

Concession Name	Bulu
Registry Numbers	Mine (Tan Noir) No. 67, April 22, 1941

(The registry date was as above, but the central areasffor mining are the original claim registries given below.)

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No. 561 (Recorded April 14, 1938)
No. 574 (" April 30, 1938)
No. 584 (" May 27, 1938).

Holder of mining rights — Bui Ngoc Phuong
No. 4 Rue des Bro-deurs
Thanh Hoa
(now moving to Hanoi)

History - This concession was discovered by our fellow countryman, Mr. Chokuji Onoda; but because of the French Indo-Chinese mining regulations it was recorded under the name of the Annamese Bui Ngoc-Phuong. Mr. Onoda went in April of that same year to French Indo-China for a re-survey and concluded a formal contract with Bui Ngoc-Phuong, this being registered on June 29th at the Vinh court. Thereafter, prospecting was carried on from November, 1938, to February of the following year. But, as a result of the [Japanese] Finance Ministry's exchange controls enacted in May of the same year, difficulties arose in transferring funds; and there were differences between Mr. Onoda's representative for paying the wages for prospecting Kishimoto Company - and the holder of the mining rights Bui Ngoc-Phuong, so that the prospecting under Article 2 of the contract document was halted. Also, there was a dispute over the export of capital under an ore-purchasing agreement concluded on January 23, 1941, between our fellow countryman Mr. Shoro Kikuchi and Mr. Bui Ngoc-Phuong, the holder of mining rights. So, there have been knotty difficulties over this concession; but through the consultation of the Japanese these apparently are being resolved harmoniously.

Terrain - It neighbors on a French-owned coffee plantation, which is on an upland in the headwaters of the Song Yen. The elevation is 120 meters; and it is on a hill rising 70 meters above the nearby valley floor. It was said that three years ago a part was cleared and burned off; but as of now it is densely vegetated with jungle, and a number of coolies are at work felling and clearing. And, with the conditions for climbing, it was difficult to make the survey of this ore deposit.

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Geology and the Ore Deposit - This region is formed of Palaeozoic slate and sandstone; but the area is much weathered, and the strike and gradient could not be measured. Also, according to the geological map of the French Indo-China Mining Bureau, there is a great outcropping of limestone to the southwest. Since at a spot not too far distant there are outcroppings of igneous rock of "desite" [phonetic approx.], this ore deposit seems to be a contact-metasomatose ore deposit born of the metasomatosing of limestone containing iron in solution. Those parts that are exposed now are all loose rock, the main body not having been discovered yet. The ore rocks on the surface are scattered for some 30 meters above the surface of the road. They are about 30 centimeters in size, with very few larger boulders. Up on the summit there are larger boulders, but these are no more than somewhat burned rocks. So, under present conditions, the ore deposits of this concession are not to be considered as anything but lumps of ore occurring around the foot of the hill from the surface of the road up some 30 meters.

The Ore and its Grade - The ore is hematite accompanied by a small amount of magnetite; the grade is 60 to 63%. Even where the quartzite content is a little high, it is but about 7%. And, the content of phosphorus and sulfur in this kind of ore deposit is believed to be exceedingly small.

The Grade of the Ore

No.	O.W.	Fe	SiO_2	Mn	Al_2O_3	CaO	MgO	S	P	Notes
5936	0.68	68.66	0.80	tr	0.83	—	tr	0.065	0.063	East part
5937	0.35	68.54	1.18	0.06	0.96	—	0.01	0.096	0.005	Entrance to west rise

(Assay by Japan Steel Pipe Co., Ltd., 1942)

The Amount of Ore - The amount of ore is computed from the dimensions - 30,000m^2 and 1 meter deep, with 0.3 tons/m^3 = 90,000 tons. As a result of the clearing and prospecting - and with the reservation of noting that the main body has not yet been discovered - the following computations were possible:

Length Regions Width

500m x 3m = 1,500m x 200m = 3000000m^2

300,000 x 2 x 0.3 tons = 90,000 tons

Mining - Mining would be by open-cut, with digging by hand power, occasionally calling for explosives - to give a production of 100 tons a day.

Mining Costs - 1.00 piasters, plus 0.50 for supervision, tools, loss and consumption: total 1.50 piasters.

Ore Sorting Costs - 1.00; earth excavation- 0.50: total 1.50 piasters.

Therefore, the overall total cost at the mine: 3.00 piasters

Transportation - The space if 12 kilometers from the minesite to the small Chiron [phonetic approx.] storage depot would be covered by small, 2-ton native craft, as well as by trucks. The native craft would number twenty, each one capable of carrying 2 tons in making a single round trip per day - a total carrying capacity of 40 tons per day. The trucks would make seven round trips per day - 21 tons. Using three trucks, the capacity would be 63 tons. And, the total of these is 103 tons. Counting on 25 working days in a month, the monthly production could be 2,515 tons, equal to an annual rate of 30,090 tons.

The 25 kilometers from the bank of the Chiron River to the storage depot at the mouht of the river could be covered by lighters of 15 to 20 tons capacity.

For the half year from April to September the weather of this vicinity is very calm, and the surface of the sea is just as if oil had been poured on it. So, during this time, loading would be easy. But, for the other half of the year there is so much wind and wave activity that it would be dangerous for the lighters to go out to sea. Thus, the loading of the depot ships would be carried on for half the year. Yet, mining and shipping to the river mouth could be carried on throughout the year, so that the ore should be stored at the river mouth.

Mine to river shore 2km (rails, hand-pushed carts) -

6 round trips $0.50 \div 6 = 0.083$

Plus maintenance and expendables 0.25

Lighter loading 0.30

Shipping costs in 2-ton lighters to Chiron depot -

2-T lighters, 3-man crew, 1 round trip/day

$0.50 \times 3 \div 2 = 0.75$

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Loading, unloading at "Chiron" depot	0.60

Cost of shipment to river mouth - 25km, 1 round trip in 3 days with 15-ton lighters by 5-man crews -

$0.50 \times 5 \times 3 \div 15 = 0.50$

Loading at the river mouth	0.30
Total	2.70

Thus:	Expenses at mine	3.00
	Shipping expenses	2.70
	Total	5.70 piasters/ton - the base cost at the river mouth

Conclusions - The type of ore is hematite, and it is of a good grade - 61 to 62% and should be developed. Under present circumstances, the whole mine is covered by jungle and could not be adequately surveyed. Thus, the estimate of the amount of ore would permit a yearly production figure of 30,000 tons. And, should clearing, prospecting and mining be carried on at the same time, and should the main body of the ore deposit be discovered, then appropriate facilities and equipment would be needed.

(2) The Bong Hang Concession

Location and Communications - This concession is at Thanh Xa village, Tan Noir Province, Annam State, 38 kilometers north of Tan Noir. The first 33 kilometers from Tan Noir is passable by auto, but the last 5 kilometers to the mine must be covered on foot.

Name of the concession	Bong Hang
Area	3 square kilometers 1 concession
Holder of mining rights	Nguyen Suyen Ky (recorded in his name in 1941)

Originally the property of the Frenchman Mr. Gulien; we were told that this was mined under a joint agreement between the Frenchman and a Japanese, Mr. Mizuya.

Terrain, Geology and the Ore Deposit - Located on a hill 56 meters above the paddy fields. The geology is chiefly Palaeozoic slate. Strike is N20°-30°W, and gradient to the southwest 20°-50°. The ore deposit is

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limonite, permeating into the slate. When sorted, the ore would not even reach a grade of 50%. So, it is not now manageable as ore.

Grade of the ore:

NO	C.W.	FE	SIO_2	MN	AL_2O_3	CAO	MGO	S	P	NOTES
5938	96.3	53.71	5.04	0.43	4.39	-	0.01	0.090	1.410	LIMONITE ORE
5939	1.29	62.07	9.28	0.02	0.83	-	TR	0.072	0.132	HEMATITE ORE FROM NEIGHBORING MINE

(Assay by Japan Steel Pipe Co., Ltd., 1942)

Addenda - Four kilometers north of here, we were told, there is hematite; therefore we surveyed it and found a large outcropping of dioritic porphyry, part of which has been subjected to pressure and pulverized. Adjoining the porphyry is a very quartzified zone. And, there is a random scattering of quartzite, breccia, etc., in the midst of which are admixed a good many fragments of white quartz and quartz-quality hematite. There is nothing of any economic value. Beyond the quartzified zone are odd-shaped limestone mounds standing like inverted rock bowls in the paddy fields. According to the French Indo-Chinese Mining Bureau geological map, this region is made up of Palaeozoic strata.

[Omit major section C., per instructions]

D. MANGANESE AND IRON ORE STORED IN THE VICINITY OF VINH

Summary

(1) The manganese and iron ores in the vicinity of Vinh have been mined since four or five years ago and hauled out by Kishimoto Trading Company (This name has now been changed to the Sanko, Co., Ltd.) and by Mr. Shusho Yokoyama, a resident of French Indo-China. Already about 8,000 tons of manganese ore and 40,000 tons of iron ore - a total of around 56,000 tons (to 1939)-have been exported to Japan.

(2) From 1940 mining has been halted due to export prohibitions and other conditions. This survey showed that the ore in storage at the present time amounts to about 21,613 tons of limonite (containing 50 to 53% iron), about 511 tons of manganese ore in the form of pyrolusite (40% manganese), approxi-

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No	C.W.	Fe	SiO_2	Mn	Al_2O_3	CaO	MgO	S	P	Notes
[illegible]	96.3	58.71	5.04	0.43	4.39	—	.0.01	0.090	1.410	Limonite ore
5989	1.29	62.07	9.28	0.02	0.88	—	tr	0.072	0.132	Hematite ore from neighboring mine

mately 723 tons of wolframite ore (30% Fe, 15% Mn), for a total of 22, 847 tons.

(3) Ore in storage at the sea-coast storage depots (Hai Yen and Dong Ken storage depots) amounts to 10,121 tons, while at the minesites and the relay storage sites there are 2,726 tons. With the present facilities it would take twelve months to haul this out from the mines to the coastal depots. With the loading of the depot ships impossible from March to April (If the new Hon Nieu storage depot becomes available, loading of the depot ships would be possible throughout the year), to begin shipping the ore out to the coastal depots (and to begin mining at the same time) would require arrangements for putting the depot ships en route. Under present arrangements, the loading capacity for depot ships is about 800 tons for a 24-hour operation. And, shipment of the stored ore would cost 7 piasters F.O.B.

(4) As for subsequent mining and shipping, even if a re-survey should be made of the deposits and a report rendered, it would not be difficult to export almost 100,000 tons of annual production to Japan from the concessions already known in the Vinh area, with the supply of new mining tools and equipment (rails, dynamite, hand trucks), newly constructed lighters and the new facilities of the Hon Nieu storage depot. And, we believe that an F.O.B. price of less than 10 piasters, roughly, would apply.

(5) If the operators on the spot are short on capital, permission for exchange could be expedited; and at the same time the hauling out of the stored ore could be gotten under way.

(6) The shoreline in the vicinity of Vinh is shallow for some distance out; and from September to the following February the surf is so high that it is not possible to navigate out through the mouth of the Song Ca (from the Hai Yen storage depot); and so, too, is it impossible to ship by native craft to Haiphong. Three 300-ton steamboats are plying from Haiphong to Ber Thuy, 4 kilometers south of Vinh on the bank of the Song Ca. These carry baggage. If these vessels could be used, it could be possible even now to ship the ore to Haiphong. But, still the shortage of [sea-going?] bottoms would make it impossible to use this kind of steam vessel.

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1. Location and Communications

(Cf. Figures 1 and 2)

The city of Vinh is the main city along the north coast of Annam; it may be reached from Haoi 320 kilometers away by express train (diesel powered) in six hours.

The iron and manganese areas are about 50 kilometers inland from Vinh and number over thirty (1 mining area 83 square kilometers) [?]; and all are in the Song Ca watershed basin or on the seacoast. Communications and transportation are both convenient either to water facilities or to auto.

More than thirty of the concessions are found through the (1) Van Trinh, (2) Vo Nguyen, (3) Yen Cu, (4) Huong Khe and (5) Dong Ken regions.

Communications for these regions are as follows:

(1) Van Trinh Region

Vinh $\xrightarrow[\text{25km}]{\text{auto}}$ concession (Cua Lo River basin)

(2) Vo Nguyen Region

Vinh $\xrightarrow[\text{about 40km}]{\text{auto}}$ concession (Song Ca main course

(3) Yen Cu Region

Vinh $\xrightarrow[\text{13 km}]{\text{auto}}$ concession (Song Ca main course

(4) Huong Khe Region

Vinh $\xrightarrow[\text{about 36km}]{\text{train}}$ Hoh Duyet $\xrightarrow[\text{10 kilometers}]{\text{small native craft}}$ concession (Song Ca tributary area)

(5) Dong Ken Region

Vinh $\xrightarrow[\text{about 27km}]{\text{auto}}$ (Impassable for last 12km during storms & high tide) concession

2. The Concessions

(a) Concessions with which Mr. Yokoyama is associated:

(1) Bo Ta [phon.] Nguyen Region

Xuan Loi - 1 concession (manganese), almost completely mined out

(2) Huong Khe Region

About 23 concessions (iron and manganese), main body has been mined in the past

(3) Dong Ken Region

1 concession (iron and manganese)

Total: about 25 concessions

Holders of mining rights

(1) Bui-Huy-Tin, Hue

(2) (3) Nguyen-Xuan-My
54 Henri Riviere, Vinh

Ore buyer (Financial help with mining capital, technical

guidance: Mr. Shusho Yokoyama
60 Bonnal, Haiphong
Tel. 412

(b) Concessions with which the Sanko Co., Ltd. is associated:

(1) Van Trinh region	1 concession (iron)
(2) Yen Cu region	1 concession (Fe and Mn)
(3) Vo Nguyen region	1 concession (Fe and Mn) almost mined out
(4) Dong Ken region	1 concession (Fe and Mn)

Total: 4 concessions

Holder of Mining Rights:

(1) (2) (3) Phuc-Thanh et Nha, Vinh

Ore buyer: Sanko Co., Ltd.

3. History

a. Ore with which Mr. Yokoyama is associated:

After forming an association with the Annamese Bui-Huy-Tin and mining manganese ore from the Xuan Loi concession, as well as iron ore from the Dong Ken concession, Mr. Yokoyama is said to have sent one shipload of ore to Japan through the hands of Mitsui Bussan in 1936. In 1938, he again exported about 30 tons of iron ore from the Dong Ken concession. And, in about March, 1938, he formed an association with the Annamese My to undertake the mining of iron ore from the Huong Khe concession. In July, 1939, he sent about 8,000 tons of Dong Ken iron ore through the hands of the Chunichi Shipping Company to Japan Steel Pipe [Company].

In February, 1939, the Japan Steel Pipe Company technicians Jiro Takahashi, Masutaro Kato and Kuruyama surveyed the concessions with which Mr. Yokoyama was associated and decided to buy the ore for Japan Steel Pipe

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Company; and in the same year in July about 8,000 tons was loaded on one ship for shipment to Japan Steel Pipe. But, because of the export prohibitions and the lack of approval for exchange, it was halted. In September, 1940, when the Imperial Army occupied French Indo-China, the Japan-French Indo-China economic agreement came into effect, so that in April of that year the results of the survey by Japan Steel Pipe's supernumerary Jingosho Hayashi and his assistant, Bokuraizan Ishibashi gave rise to hopes for some positive ore sales. Again, with the co-operation of Mr. Yokoyama and with the goal of aiding Mr. Yokoyama, the ancillary company of Japan Steel Pipe - the Nanyo Iron Ore Company, Ltd (which was managing iron mines on the Malay Peninsula, but had suspended operations because of the emergency) - was brought in with the responsibility of developing those deposits. It requested the construction of new operating facilities, as shown in the figures on a separate sheet. This was granted on August 22, and they began accumulating the ore in storage. At the same time they were expecting thereafter to dispatch five specialists to the scene to prepare for the development. They are now awaiting the results of this survey of this Natural Resources Survey Mission. As these specialists lack approval for their passage, Xuan Loi will be the concession that they begin on for the present. Then, in succession mining will be undertaken in the Dong Ken and Huong Khe regions. But, because of the uncertainties of exporting matters, energetic mining operations have been suspended since 1940.

(b) Concessions with which the Sanko Compnay is associated:

In 1935 the company associated with the Annamese Than, and mining was undertaken at the manganese mine of the Yen Phu [phon. approx.]; and it is said that there has been a subsequent development of the Van Trinh, Tong Kun [phon. apprx.] and Vo Nguyen concessions.

From the first shipment in December, 1936, until 1939 nine shipments were made to Japan Steel and Japan Iron. The amounts were as follows:

Manganese ore	about 8,000 tons
Wolframite ore	about 8,000 tons
Iron ore	about 30,000 tons

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With mining and export having been uncertain from 1940 - as noted above - operations were suspended; but at present in the Yen Cu concession about 30 coolies are being used for mining manganese ore only.

4. Ore in Storage (Figure 2)

From our actual inspection of the ore in storage in the concessions and at the river mouths the rough figures given below were derived. The amounts were measured by tape on the basis of these weights per cubic meter:

Iron ore	1.7	tons
Manganese ore	2.0	"
Wolframite ore	1.8	"
clay	2.0	"

The grade would have to be judged from the results of assay for market profitability. And, when wolframite and manganese ore showing a fine grade to the unaided eye are mined from the same ore deposit as the iron ore, the high-grade parts can be separated out from the iron ore - again, hand sorted - giving the categories: manganese, wolframite, and iron ore.

A. Iron ore (Limonite grade - 50-53% Fe, less than 10% silicate; Fe rate of 60% after hand sorting)

(1) Huong Khe concession	crude ore	15,924 tons
	refined ore	9,554
(2) Dong Ken concession seacoast	crude ore	3,152
	refined ore	1,891
(3) Hai Yen storage depot	crude ore	6,724
	refined ore	4,034
Totals:	crude ore	25,800
	refined ore	15,479

B. Manganese ore (Pyrolusite: grade is 40% Mn, 70% SiO_2, and hand-sorting rate - 70%)

Dong Ken concession seacoast	crude ore	195 tons
	refined ore	137

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C. Wolframite Ore (As an admixture of hematite and pyrolusite, the grade is Mn 15%, Fe 30% and SiO_2 under 10%; hand-sorting rate: 60%)

(1) Dong Ken concession seacoast	crude ore	280 tons
	refined ore	168

Total of the above refined iron and manganese ores 22,847 tons

Sanko Company's Share

A. Iron ore (Limonite and limonite containing hematite: grade - Fe 50-53%, SiO_2 under 10%)

(1) Van Trinh concession	crude ore	1,079 tons
sorting rate - 60%	refined ore	647
(2) Cua Ro storage depot	crude ore	4,127
sorting rate - 60%	refined ore	2,476
(3) Yen Cu concession	crude ore	55
sorting rate - 70%	refined ore	39
(4) Hai Yen storage depot	crude ore	2,615
sorting rate - 70%	refined ore	1,831
Other locations, granular ore	refined ore	1,141
Totals:	Crude ore	9,000 tons (approx.)
	Refined ore	6,134

B. Wolframite ore (Limonite ore containing manganese; grade: manganese 15%, iron 30%, silicate under 10%)

(1) Yen Cu concession	crude ore	13 tons
sorting rate - 85%	refined ore	10
(2) Hai Yen storage depot	crude ore	391
sorting rate - 70%	refined ore	313
Other locations, granular ore	refined ore	232
Totals:	Crude ore	about 700 tons
	Refined ore	555 tons

C. Manganese ore (Pyrolusite ore; grade - manganese 40%, silicate 7%)

Hai Yen storage depot	crude, granular ore	about 500 tons
	refined ore	374

Total of above refined ore - 7,063 tons

Then, the ore in storage in the vicinity of Vinh totals 22,847 tons overall, which is broken down as follows:

Iron ore (Fe 50-53%)	21,613 tons
Manganese ore (Mn 40%)	511
Wolframite ore (Mn 5%, Fe 30%)	723
Total	22,847 tons

5. On Shipping the Stored Ore (Figures 1, 2 and 3)

For loading the depot ships, the ore must be taken from the Hai Yen storage depot in large native craft (40-50 ton burden and 70-80 ton), because of the lack of ports and harbors in this vicinity, and then must be taken to Haiphong. There it would be loaded onto the depot ships. As an alternative, the large native craft could take the ore two kilometers into the offing from Hai Yen storage depot for loading onto the depot ships.

The sea coast in this vicinity permits the seasonal anchoring of depot ships, from March through August every year; but since from September to the following February high winds and waves make navigation by lighters and the loading of the depot ships impossible, loading in the offing of Dong Ken and Hai Yen must be from March to August.

Of late, Mr. Yokoyama has devised a plan whereby a storage depot would be constructed on Hon Nieu Island, three kilometers out to sea from Hai Yen. Under this plan, the lee side of the island could be used for loading depot ships even in stormy weather, he says. The writers went by launch to Hon Nieu Island on December 1st to inspect the condition of the sea and the storage site. While the loading of depot ships near the mouth of the river at Hai Yen would have been impossible, in the lee of Hon Nieu Island the waves were quiet. According to the marine charts (Figure 3), Hon Nieu Island would permit the anchoring of 7,000-ton to 8,000-ton depot ships 700-800 meters in the offing. Thus, we feel that the island shouls be used as a storage depot in the future.

At present, ore is stored in a total of seven places. The routes for hauling it out are as follows:

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A. To Hai Yen storage depot

(1) (Sanko) Yen Cu storage $\xrightarrow[\text{hand-pushed wheelbarrows}]{\text{200meter trail}}$ river side $\xrightarrow[\text{7hrs down, 12 back by 50-ton lighter}]{\text{35km by water}}$

thence to Hai Yen depot

(2) (Yokoyama) Huong Khe storage $\xrightarrow[\text{truck, humane power}]{\text{300m trail}}$ river side $\xrightarrow[\text{5-ton native craft (3-day round trip)}]{\text{27km by water}}$ to

An Phu $\xrightarrow[\text{50-T lighters (3-day round trip)}]{\text{50km by water}}$ Hai Yen storage depot

(3) (Sanko) Van Tri storage $\xrightarrow[\text{wheelbarrows}]{\text{2-km trail}}$ river side $\xrightarrow[\text{15-T vessels (1 to 1½-day round trip)}]{\text{13km by water}}$ to

Cua Ro storage point $\xrightarrow[\text{15- to 20-ton vessels (1 to 1½ days)}]{\text{12km by sea}}$ Hai Yen storage depot

B. (Yokoyama) Dong Ken Storage Depot (seacoast)

The depot ships are loaded two to three kilometers in the offing.

(1) Huong Khe Storage Ore-Shipping Capacity

According to past experience, 5-ton vessels can be handled in the amount of sixty per day. And, it is said that occasionally as many as about ninety can be loaded in one day. In such a case, 150 tons were sent to the An Phu storage point; and in one month 3,000 tons could be taken out.

From An Phu downstream to Hai Yen some fifteen loads can be hauled by the 30-ton to 50-ton vessels so that 3,000 tons a month would be the norm. Thus, to haul out the 9,500 tons stored at the Huong Khe concession as far as the Hai Yen depot would require more than three months. If the number of native craft used and the number of shipments made were to be increased, then the limiting factor would be the number of native craft and the weather. On top of this, the native craft, being hired, would have to vary in number according to the level of activities, so that if high production is desired in the future on a regular basis, it will be necessary to undertake the construction of new vessels.

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(2) Shipping Capacity for Ore Sotred at Yen Cu

Shipping out the 49 tons of refined ore to the Hai Yen storage depot could easily be accomplished with the average 40 tons/day capacity from three 20-ton to 30-ton boats or with a 50-ton lighter.

(3) The Shipping Capacity of Van Trinh Stored Ore

0.5 tons of ore can be taken out per person per day by wheelbarrow from the mine to the river side; and 100 tons a day can be brought out using 200 men for the hauling. Thus, to bring out the 647 tons of stored refined ore eleven days would be required. From the river-side storage point to Cua Ro storage depot two 15-ton vessels could transport 15 tons per day. Since twenty bottoms could haul 150 tons per day to this depot, the shipping of the ore stored at the minesite could be finished in five days. From Cua Ro storage depot to Hai Yen depot, twenty 20-ton vessels could haul all the ore in four days. In this manner, the amount of ore accumulated at the Hai Yen depot would be as follows:

Iron ore	19,722 tons
Wolframite ore	555
Manganese ore	374
Total	20,654

Besides that at the Hai Yen depot, at the Dong Ken depot there would be:

Iron ore	1,891 tons
Wolframite ore	168
Manganese ore	137
Total	2,196

If the Dong Ken depot is to have the same loading capacity as Hai Yen, it is important that arrangements for the allocation of vessels be made so that loading can begin immediately upon the start of the quiet [weather] period next year. In the meantime, minesite transportation and river shipping should be arranged for; and the hauling out of the ore should be initiated, along with the resumption of mining. Then, the output of ore to the storage depots on the coast, with the present facilities, could hereafter be 60,000 tons per year. Of this, 600 tons would be manganese ore. Also, the reports of the ore-deposit survey of manganese ore should be reported.

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The depot ship loading capacity varies with the weather, with the availability of tugs and with the size and number of lighters. But, since actual achievements in the past indicate that loading 24 hours a day in bad weather has resulted in 500 tons total being loaded while in good weather 1200 tons were loaded, the average should be regarded as 800 tons. In the future six ore seven 50-ton to 80-ton lighters and one tugboat would be used. When a number of large native vessels are used for shipping, such as ten 100-ton lighters being used with two tugboats, 1500 tons are easily loaded in a twenty-four-hour period.

6. The Cost of Hauling Out the Stored Ore

On the basis of experience with hauling out ore to the Hai Yen storage depot from the Huong Khe concession. which is associated with Mr. Yokoyama, the per-ton costs are said to be as follows:

Mine to river side		0.50 piasters
River side to Hai Yen depot		2.50
Storage at Hai Yen		0.12
Hai Yen depot to depot ship		1.50
Wages of shipnoard coolies		0.15
Mine tax		0.18
Export tax		0.12
	Total	5.07
Office costs, etc.		0.51
	Total	5.58

Recently costs have been pushed up by the rise in the cost of goods and in coolie wages, etc. Coolie wages have risen from 0.30 piasters a day to 0.40 or 0.50 piasters a day. In the past, the 5-ton native vessels could be hired for 1.20 piasters a day; now the rate is 2.00 piasters. At this rate, with costs 50% higher, the F.O.B. per-ton cost is 7.16 piasters (leaving the taxes as they stand), so that total costs - adding in 10% for office expenses, etc., amount to 7.88 piasters.

This computation seems rather too high; the costs would be something under seven piasters.

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7. On the River Shipment of the Mined Ore and Shipping to the Depot Ships

In the past, the mining of the ore has mostly been by primitive methods employed by the natives, without the involvement of any technicians. And, except for the occasional engagement of a Japanese, who worked to raise the grade of the ore, there were no positive practices for correcting the mining methods, transporting or shipping, so that it seems to have been largely a so-called native-run operation. This was pretty much true, too, of river shipping and shipping to the side of the depot ships. While the Sanko Company, Ltd., has constructed seven 50-ton lighters and used one 45 h.p. tugboat, two of the lighters have been capsized and sunk by rough waves. And, though five lighters are still in use, the inadequacies of equipment, of course has affected the output of ore. Hereafter some arrangements will be necessary to ensure the level of ore output for Japan. Japan Steel Pipe twice has sent technicians, in 1939 and in 1941, by which specialized developmental plans were drawn up for the Huong Khe concession and for loading depot ships. (In the appended volume the total capital outlay for these facilities is estimated at 200,000 piasters. This is broken down as follows - per ton:

(1)	Mining	0.993 piasters
(2)	River shipping	1.232
(3)	Loading on depot ships	1.900
(4)	Facilities depreciation	0.367
(5)	Home Company costs	0.067
(6)	On-the-spot analysis	0.077
	Total (according to appended vol.)	4.636

When mine production taxes and export taxes of 0.30 piasters per ton are added to this, the per-ton cost becomes about 5 piasters. The estimates recorded in the appended volume would be very difficult to realize with the addition of 10% for the recent rise in the prices of goods and services.

8. On Loading the Depot Ships

In the past, the coastal storage depots have been those at Hai Yen and Dong Ken, with the depot ships anchoring some 2 kilometers in the offing. The loading operation, as noted previously, can be very rough at sea depending on the season; and every year from September to the following February the lighters are unable to navigate the course. So, the loading capacity reflects a season of no more than six months. This is the major worry of the producers concerning the future of the iron and manganese mines in the vicinity of Vinh. Fortunately, it seems that Mr. Yokoyama's plan would make depot-ship loading easy within 1 kilometer of Hon Nieu Island, where a new depot would be constructed, even in stormy weather. A sketch map of the projected Hon Nieu Island storage depot is shown in Figure 4. With a storage capacity here of about 34,000 tons, ore could be shipped on quiet days directly from the mines and intermediate storage points to this island; and then loading could be handled from this island from September through February. A year-round loading capability could be acquired with this island's depot, according to Mr. Yokoyama's plan, for 7,682 piasters.

Hon Nieu Island is topographically small as a storage area; and there is not much room to spare as shelter for the lighters: a breakwater capable of sheltering ten 10-ton lighters would have to suffice. (Cf. Figure 4 and the cost estimates for the Hon Nieu Island depot and loading facilities.) The total cost of storage facilities on Hon Nieu Island is estimated at 164,000 yen. Now, against the annual production [for the region] of 100,000 tons, there would be the 50,ooo-ton Hai Yen depot and the 50,000-ton Hon Nieu Island depot. Now, the cost of the new construction on Hon Nieu Island would come to more than three yean per ton - a high rate; but in consideration of the past experience with paying fees for the lay-over of ships, it would seem to be the profitable thing to go ahead with the new consturction for the Hon Nieu Island depot.

Hon Nieu Island rises to an elevation of more than 30 meters; and according to the natives, water gushed forth from the rock when wells are dug. But, this has not been confirmed. If there were no driking water, there would be the difficulty of having to ship water from the mainland

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opposite the island.

As for the new construction for the depot, we can give no more than a rough outline; the details would require a survey by shipping and harbor specialists.

Table of Assay Results (Ore in Storage at Hai Yen)

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NO.	C.W.	FE	SIO_2	M	AL_2O_3	OHO	MGO	S.	P.	NOTES
5962	10.75	54.61	3.08	2.63	1.87	-	TR	0.010	0.663	IRON-ORE ROCK IN MR. YOKOYAMA'S ORE STORAGE DEPOT
5963	9.87	56.43	4.52	0.08	3.22	-	"	0.027	0.458	"
5964	10.57	55.52	4.10	0.34	3.28	-	"	0.034	0.415	"
5965		17.31	6.27	34.85	3.62	-	"	0.001	0.651	"
5966	0.47	54.47	18.80	3.37	1.85	-	"	0.001	0.253	"
5967	11.74	51.66	4.98	2.75	2.94	-	"	0.001	1.211	"
5968	11.61	49.95	4.01	4.22	3.61	-	"	0.001	1.177	"

(Assay by Japan Steel Pipe Co., Ltd., 1942)

[Chapter V omitted, per instructions]

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No.	O.W	Fe.	SiO_2	Mn	Al_2O_3	CaO	MgO	S.	P.	Notes
5962	10.76	54.41	3.06	2.63	1.47	—	tr	0.010	0.663	Ir[redacted] in Mr. Yokoyama's ore storage depot
5963	9.87	56.43	4.52	0.08	3.22	—	〃	0.027	0.458	〃
5964	10.57	55.52	4.10	0.34	3.28	—	〃	0.034	0.415	〃
5965		17.31	6.27	34.85	3.62	—	〃	0.001	0.651	〃
5966	0.47	54.47	18.80	3.37	1.85	—	〃	0.001	0.253	〃
5967	11.74	51.66	4.98	2.75	2.94	—	〃	0.001	1.211	〃
5968	11.61	49.95	4.01	4.22	3.61	—	〃	0.001	1.177	〃

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CHAPTER VI

MANGANESE ORE OF THE CAO BANG AREA, TONKIN STATE

Period of Survey January-February, 1942

Surveyor B Team, Iron-Manganese Group

Section 1. Summary and Conclusions

In the vicinity of the border between northeast Cao Bang in Tonkin State and Kwanghsi Province in China there are a number of manganese ore deposits. This survey was chiefly of the important parts already known.

In this region Palaeozoic strata of the Devonian, Permian and Carboniferous periods are widely distributed. These are chiefly Palaeozoic limestone. The youthful karst terrain is well developed here. Among the ore deposits there are two types. One is mainly "layer-form ore deposits" contained in Palaeozoic strata - mainly limestone, with some quartzite and sandy slate. These are of irregular shape, or almond shape. Not only are their dimensions modest, but they actually are small-scale deposits that cannot be expected to last long - being shallow, remnant deposits that have incurred the effects of secondary weathering. The other type consists of large and small fragments of ore derived from the first type of deposit, the so-called "loose-rock ore deposits," deposits in the terra rossa soil that has accumulated in Doline and Uvala type basins or hollows among the limestone hills. Also, this type of ore deposit is not striking in scale of distribution or in the depth or ore content of the ore-bearing soil.

The ore is oxidized manganese ore - hard manganese ore, soft manganese ore and manganese earth. No manganese carbonate or manganese silicate ores have yet been found among them. The grade of the ore is generally good; the loose-rock ore deposits are especially so, with about 53% manganese. In the layer-form ore deposits those deposited underground have about 44% manganese, while those in the vicinity of outcroppings contain around 50% manganese.

Totalling the amount of ore found by this survey, we get 14,630 tons; and by a more precise survey this probably could be brought to no more than 15,000 tons.

The ore deposits of this region have ore of a generally good grade, and have the point in their favor of generally being so deposited that mining operations are easy. But, the sites are remote, far from the sea and the harbors. Shipping overland alone to Haiphong would cost around 40 to 50 piasters for freight - a direct obstacle, so that as yet there is almost no development. Such high freight charges derive chiefly from long-distance trucking. This is a most difficult problem, not easily resolved and additionally troublesome because of the small amount of ore. In case it is expected to produce ore from this region, a high base price will be unavoidable. Yet, under the most recent situation of insufficient fuel and vehicles, many difficulties attend upon transportation that is conducted by requests to truckers and shippers. Under the present shortage of manganese ore, management of the mining operations here must be handled by the French and Annamese in order to supply an appreciable amount of the ore to Japan; but it will be necessary to institute a policy of using Japanese fortrucking facilities to haul out the ore. And, as the amount of ore is rather small, overall development for the whole producing area should be planned, thus spreading the losses among all the deposits and rationalizing the use of trucking. Should the mining of the ore and the management of the trucking be otherwise entrusted and the ore simply be purchased at Haiphong, it would not be possible to realize a harmonious and thorough-going ore production from this region.

Section 2. Introduction

In the many ore deposits of this region are a number of mining concessions and prospecting concessions. Since the region is remote, surveys have not been adequate. Except for one ore deposit where small-scale operations are under way, the whole aspect of this manganese-ore producing area is unknown. However, the nearby Kwanghsi Province is a manganese-ore producing area of some prominence, so that we may expect large deposits to be hidden in this present region. And, even though individual deposits are small scale, if a large number of deposits are developed under an over-all, co-ordinated policy, a respectable amount of ore production could be realized, and rather consequential results could be expected for the future.

From January 26, 1942, to February 12 - an eighteen-day period - the B team of the Iron-Manganese Group carried out the manganese survey of this region. The survey members and their duties were as follows:

Geology and Ore Deposits	Group member	Masaji Saito
Same - assistant	Temporary member	Kenji Yamasaki (staff of Ishihara Industrial & Marine Transport Company)
Topographical measurements	Attached member	Jikan Kagami
Same - assistant	" "	Joei Motomura
Interpreter	Temporary member	Tetsuzo Kubota

Among the survey members there were none with the chief duty of matters relating to mine development and mining operations, so that group member Saito, with the assistance of temporary member Yamasaki gave some attention to such matters.

Not only was it totally impossible in the time available to conduct a survey of the whole region, with all its many manganese deposits, but also, from what we heard, there has been no survey at all in the prospecting concessions, these having been set up merely for the purpose of holding the mining rights. So, under this survey we planned first of all to question the Japanese companies in French Indo-China and the French Indo-Chinese officials, and to survey the sites to confirm the ore deposits. And, in carrying out the survey, we also added to the survey those areas that we had heard were promising. Consequently, this survey can only be considered to have covered the important, known ore-producing areas of this region. However, the ore-producing area near Trung Khanh Phu was omitted, mainly bedause of time limitations.

Section 3. Discussion

1. Concessions

The mining concessions and prospecting areas related to manganese in the Cao Bang region are as in the Appended Figure No. 2 and in the following table. And, in Appended Figure No. 2 there are recorded also the manganese deposits surveyed this time. In the survey we discovered manganese ore in some completely unexpected places. Also, according to the natives, there are ore deposits outside the survey area, too, supporting the belief that there are many manganese deposits across this whole region.

Table of Mining Concessions and Prospecting Concessions Connected with Manganese in the Cao Bang Region, Tonkin State

Number	Name	Date Recorded	Mining Right Holder	Notes
Mining concession	Toc-Tat	Jun. 7, 1937	Subira, Bertrand	Approved for mining 1-3-1931 under No. 54
Same	Hung	Apr. 22, 1928	Subira, Bertrand	Approved for mining 1-3-1939 under No. 54
1316	Lang O	Feb. 13, 1939	Nongich	
1318	Wnjuerite[sic]	Mar. 13, 1939	Ngo Viet An	
1327	[- blank -]			
1328	Yueline	June 5, 1939	Martin, Roger	
1329	Rue	"	"	
1330	Kili	"	"	
1331	Lulu	"	"	
1332	Clemenceau	Jun. 19, 1939	To Phuong Tap	
1333	Leda	Jun. 30, 1939	Pascal, Thebert	
1335	Lung Riec	Jul. 27, 1939	Ferriece, Paul	
1342	Ma Phuc	Feb. 13, 1940	Ngo Viet An	
1344	Daloi	Sep. 26, 1940	Ngo Quang	
1345	Kien Son	Mar. 18, 1940	"	
1351	Na Quang	Aug. 21, 1940	Subira, Bertrand	
1353	Marie	Oct. 17, 1940	Robert, Joseph	
1354	Marguerite	"	"	
1355	Therese	Oct. 21, 1940	Ng. Chinh Tuc [sic]	
1371	Song Thay	Jun. 24, 1941	Pham van Khiet	
1372	Ban Sao	Jun. 30, 1941	Ha Vane Mas	
1373	Hu Le	"	"	
1374	Na Cha	"	"	
1378	Ngan Hanh	Jul. 11, 1941	Ng Van Duoc	
1390	Cidim 6	Sep. 29, 1940	Indo-China Mining	
1391	Binh Trong	Sep. 29, 1941	Subira	

1392	Cidim 2	Oct. 1, 1942	Indo-China Mining
1393	Cidim 4	"	"
1394	Cidim 5	"	"
1395	Cidim 6	"	"
1396	Cidim 7	"	"
1397	Cidim 8	"	"
1398	Cidim 9	"	"
1399	Cidim 11	"	"
1400	Cidim 10	"	"
1401	Sañh	Oct. 7, 1941	Nguyen Van Duoc
1402	Cidim 12	Oct. 8, 1941	Indo-China Mining
1408	Cidim 13	Oct. 20, 1941	"

2. Communcations

Cao Bang is the central city of this region and is the site of the headquartebs for the French Indo-China Second Military District. The administration of this region is mot assigned to any special administrative official but comes under the jurisdiction of the same military headquarters. To reach Cao Bang from the Hanoi area, one can go directly by auto. There are two auto highways. (Cf. Appended Figure No. 1) One, the Colonial Highway No. 3, goes from Hanoi through Thai Nguyen, Bac Kan and Ngan Son, the total distance from Hanoi to Cao Bang being 287.5 kilometebs. The other route foes by Colonial Highway No. 1 from Hanoi through Phu Lang Thuong to Lang Son. From Lang Son, Colonial Highway No. 4 goes through Na Cham and That Khe to Cao Bang, the distance from Hanoi to Cao Bang here being 290.5 kilometers. Neither route differs much as to distance, and both are very fine roads. But, of the two the latter is the better road. By either highway, one can leave Hanoi early in the morning and reach Cao Bang usually by evening. Also, there is the system of taking the train on the Nacham line to Nacham and chaging there to a public bus which goes through That Khe to Cao Bang.

To reach the site of the ore deposit from Cao Bang there are three highways, as shown in Appended Figure No. 2: the Cao Bang-Quang Uyen (37km from Cao Bang, central town for the administration of this vicinity, as well as for commerce and military matters related to policing the

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border)-Trung Khan Phu (garrison point for the border patrol) road; the road branching off from it at mid-point and going to Tra Linh (36 km from Cao Bang, and a garrison point for the border patrol); and the road paralleling the border between Tra Linh and Trung Khan Phu. These roads all thread through precipitous mountains of limestone or follow along the valleys between the mountains. Grades and curves are very frequent. Of the three roads, the best is the Cao Bang-Quang Uyen-Trung Khanh Phu road, which easily passes large, freight-carrying trucks. The road to Tra Linh has a somewhat poor surface, is narrow and has steep grades. The passage for large trucks is somewhat difficult. The Tra Linh-Trung Khanh Phu road carries little traffic and has a somewhat rough surface. If the bridge (about 30 meters long) in front of the Tra Linh army camp and the one (about 50 meters long) some 16 kilometers from Tra Linh in the neighborhood of Ban Sac village are not repaired, it will not be possible for large trucks to pass along here.

The manganese-ore producing areas surveyed this time are from several hundred meters to about 1 kilometer removed from these roads. In between there are only village trails, which can only be walked. These wind through precipitous limestone hills and have many washouts and caveins and limestone outcroppings along them - very poor trails.

4. Terrain and Geology

According to the Cao Bang sector of the 500,000:1 and 1,000,000:1 geological maps published by the French Indo-China Geological Survey Bureau, the geology of this region is chiefly limestone strata of the Devonian and Permian periods. In the zone surveyed there is some quartzite, phyllite and sandy clay-slate included in the Devonian strata; but these Palaeozoic strata are almost entirely limestone.

A young karst terrain is formed by the limestone mountain area - mountains and hills of the type seem in Chinese paintings of the Southern [Sung] school, with strange, bold rocks, sharp peaks and sheer cliffs, while Doline, Uvala or Polje type hollows are well developed and scattered about without order. In general, in the bottom of the hollows there is thickly deposited terra rossa-type red earth. No flowing streams are to be seen, for near the center the rain water must sink into the earth and

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sink-holes. In the somewhat larger hollows there are stream beds, but this water system includes not a few underground streams and geysers [artesian wells?]. Besides the limestone terrain, the area occupied especially by phyllite and sandy clay-slate is generally a gently sloping hill area of moderate appearance.

The limestone mountain area is unfavorable for the growth of trees, so that only scanty woods or stunted trees are found. The low hilly area is almost totally lacking in trees; and the hills are grassy instead, in the main showing a gentle, open pastureland type of scenery. The valleys lined with terra rossa extend fairly far into the mountains, forming cultivated areas of dry fields and paddies. Here are scattered the small villages of the Non, Tou and Man [all Phon. approx.] tribes, with many trails connecting them.

Besides the above-noted Palaeozoic strata, there are outcroppings here and there, these being veins of greem igneous rock. And, in the lowlands along the river channels there are deposited small-scale alluvial strata.

4. The Ore Deposits

The manganese ore deposits are in a region of Palaeozoic strata - in Devonian, Permian and Carboniferous strata. Within the limits of this survey, deposits of rather large scale predominate in the Devonian strata. The green igneous rock is totally unrelated to the distribution of the ore deposits, and no affiliation can be detected between this rock and the origin of the ore deposits.

(1) Layer-form Ore Deposits

This kind of deposit is laid down in strata form, usually in the limestone, and occasionally in the quartzite or snady clay-slate. The deposits are of irregular shape and generally are small scale. The width of the deposits is under one meter, or several tens of centimeters; but in some places it changes to a richer deposit. The length along the strike is usually 20 to 30 meters; but occasionally it is longer and sometimes is divided into many almond-shaped ore bodies lined up in rows. The ore rock is oxidized manganese ore. Here no manganese carbonate ore or manganese silicate ore is to be found. Othe r than a considerable amount or hematite and limonite along the surface of the ore deposits, the deposits have incurred no changes wahtsoever from the limestone matrix. The ore near to the outcroppings is generally of a very fine grade; but deeper down the ore contains a large amount of matrix rock and changes into breccia and rope forms. And, it is always of a lower grade than the ore near the outcroppings. Thus, deeper down there would be no large continuations sufficient for mining. It is not clear whether this kind of ore deposit was once ore strata which has now been deposited, or whether ore veins were formed along the face of the strata. Such primary ore deposits are generally of low grade not good enough for mining. The parts adequate for working are those that have been exposed and incurred secondary weathering effects.

(2) The Loose-rock Ore Deposits

This kind of ore deposit is a broken and fragmented ore deposit deriving from the layer-form ore deposits. They are made up of loose manganese ore rocks mixed into the terra rossa soil that covers the gentle slopes of the hollows among the limestone mountains or the peaks and flanks of the hills. The basic type layer form ore deposit is more often completelyfragmented, with loose-rock deposits occurring on the upper slopes. These loose ore rocks are genrally less than the size of the human head and occur in nodular form, in forms with many fracture planes, and in sheet-form. Rarely is there any boulder as large as an ox or a horse; and when they are to be found, many of them have adhering limestone. When they accompany the layer-form ore deposits, the loose rocks always correspond in external appearance and internal structure with the rock of the layer-form deposits. And, part of the manganese in the deposits has dissolved out, permeated into the soil and thus been redeposited.

The grade of the ore is generally very good. However, the ore deposits are not large scale; and their three dimensions are genrally small.

5. The Ore

The ore is hard and soft manganese and manganese earth. There is an admixture of small amounts of hematite, limonite, rarely quartz and a small amount of matrix rock. The ore rock is mainly non-crystalline. And, there are two kinds - either balck or purple-black and steel-gray

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with metallic lustre. Occasionally, there are steel-gray crystals of a long pillar shape or a fish-scale shape. In the structure of the ore there are such forms as fine-grain ore, "coarse-hair granules, a very porous ore, black and gray banded ore and tubercle-form ore. Particularly the ore rock in the deposits contained in the shady clay-slate a thin-banded form is found, which is abundant in slate-type plate-form foliated rock. On the exfoliated surface of such ore rock there are often pits and protruberances, showing an unclear fish-roe structural form.

The grade of the manganese ore of this region is good. The loose-rock ore is especially of very fine grade, excluding a small-scale deposit in one section.

The ore rock of the layer-form deposits is of very high grade in the parts near to outcroppings; but in general the grade is low compared to the loose-rock deposits.

6. The Amount of Ore

The average grade and amount of manganese at ten surveyed sites were used to compute the amount of ore, as follows:

Ore-producing area's name	Average grade of ore - %Mn	Amount of Ore
Khan Chang	-	Slight amount
Povien	54	500 tons
Lung Ri	53	100
Lung Pao	-	Slight amount
Lung Rioc	46	160
Lung Luorg	47	160
Ban Mac	44	650
Toc-Tat	50	8,220
Ban Sac	49	2,480
Hung	45	2,000
	Total	14,630 tons

The five ore deposits at Toc-Tat, Hung, Ban Sac, Ban Mac and Povien are considered to have enough ore to make them worth consideration from an economic standpoint, as a result of this survey. The other deposits have but a very insignificant amount of ore and are held not to have any value for working. And, even among the above-noted deposits, the Toc-Tat mine - with the alrgest amount of ore - has less than 10,000 tons of ore. And, even if the 14,630 tons contained in the deposits surveyed were to be increased through a more detailed survey, the total still would not exceed around 15,000 tons. And, though this survey was confinsd to the known deposits, this is not a matter for concern since the area outside of the survey region is not conducive to firm expectations. With relatively few dense forests, this region has been cleared for cultivation deep into the relatively inaccessible mountain areas, which makes it difficult to expect that there would be any large unknown ore deposits lying hidden here.

7. Conditions for Development

Not only are the total known reserves of this whole manganese-ore producing region small, but also the amount of ore in each individual deposit is not large. Arrangements for development should be very closely limited, with no more than small-scale operations being undertaken. And, with the existing problems the annual production of ore must remain greatly restricted.

The loose-rock ore deposits would be open-cut mined; thus the ore near the surface could be worked easily. The layer-form deposits should be partly mineable as open cuts, but the main parts would have to be mined from pits. However, the ore deposits do not continue deep down, and even the pit mining would generally be simple. Since each deposit has but a small amount of ore, there would be insufficient justification for the new construction of special auto roads from the deposit sites to the existing highways nearby. The best that could be done would be to convert the village trails into horse-cart roads. Or, depending on the deposit, it might be possible only to haul the ore by human power. On the basis of the highway network, auto [truck] transportation from the neighborhood of the ore deposits would all pass through Cao Bang. Transporation costs from the minesites to Cao Bang would vary from mine to mine; this is dealt with in the discussion of each deposit, but it runs from 12.50 to 17.50 piasters. From Cao Bang to Haiphong the ore would be hauled by truck to Na Cham, and from there to Phu Lang Thuong by railway. From there on, the best means of transportation is by lighter down the river to Haiphong. The shippers of the tin ore from the tin mine at Tinh Tuc, 64 kilometers west of Cao Bang are said to have contracted for hauling their ore for approximately 170 kilometers from Tinh Tuc to Na Cham at a cost of 35 to 36 piasters. Consequently, the freight cost for the manganese ore for the 105 kilometers from Cao Bang to Na Cham would have to be at least 24 piasters, taking into consideration such unfavorable shipping conditions as the smallaamounts to be shipped and the irregularity of the shipments. Tentatively, the cost of freight from Cao Bang to Haiphong is computed as follows:

Trucking, Cao Bang to Na Cham	105km, $4\frac{1}{2}$ hours one way	24.00 pias.
By rail, Na Cham to Phu Lang Thuong	129 km	4.00
Lighter, Phu Lang Thuong to Haiphong		2.60
Other: re-loading & storage at Na Cham and Phu Lang Thuong, & unloading at Haiphong		0.75
	Sub-total	31.35
Plus 12.50-17.50 for trucking from minesites to Cao Bang:		43.85 to 48.85 piasters

The direct reason that the manganese ore deposits of this region have not been developed previously is the high 40-50 piaster cost of overland shipment to Haiphong. Of these shipment costs, the highest is from the minesites to Na Cham by truck. On this point, this survey demonstrates that the basis for it is the small scale of the deposits and the trifling amount of ore; and this is believed to be a difficult matter to improve.

Under recent conditions, there has arisen a shortage of fuel and vehicles in French Indo-China; and generally shippers are operating under severe limitations. Hwere they can load consumer goods in the trucks for the return trip from Na Cham to Cao Bang, there is no use for the empty trucks returning from Cao Bang to the remote minesites. Thus, we hope that it will be possible to make special arrangements for joint [co-operative] trucking of the ore. However, with butaa small amount of ore in each deposit, it would not do simply to set up the trucking for each mine. Instead, there should be a gradual development of the whole region on a unified basis. Thus, the burden of the trucking costs could be divided between each mine. Just entrusting the minesite operations to the French

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and Annamese and simply buying up the production at Haiphong would probably make it difficult to bring about the harmonization of ore production in this region.

Now, if we add to the above shipping costs

Storage at Haiphong, loading on depot ships (including lighterage)		0.80 piasters
Sea freight to Japan		12.00
	Sub-total	12.80

the total freight from minesite to Japan becomes 56.65 to 61.65 piasters. If we calculate into this also the minesite base cost, mining taxes, export tax, loss, etc., the price on reaching Japan (not putting the ore into burlap sacks) would probably amount to 70-odd piasters.

8. Conditions of Peace and Order

This region is near to the French Indo-China border with China; and the ore deposits that are particularly expected to be worked are mostly right on the border. Consequently, with the terrain - conditions of access and policing being what they are - it is very easy for any kind of disaffected insurgents to cross over secretly from China. Also, there are many natives of French Indo-China who are of Chinese extraction, so that conditions are such that special bandits make sudden forays. Consequently, there are unexpected dangers to working the mines of this region. Therefore, some thought must be given to the maintenance of peace and order.

Section 4. Discussion of Individual Ore Deposits

1. The Khan Chang Ore Deposit

(1) Name of Mine

None. We have applied the name of the nearby village.

(2) Mining Rights

The ore deposit is in the following prospecting concessions

No. of Prospecting Concession	Name	Date Registered	Holder of Prospecting Rights
Cao Bang 1344	Daloi	Feb. 26, 1940	Ngo Quang

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(3) Location

At Khan Chang village, about 16 kilometers from Cao Bang on the Cao Bang-Quang Uyen road. The ore deposit is about 40 meters east of the village, across the paddies in the vicinity of a hill.

(4) Geology and the Ore Deposit

The geology of this vicinity consists of Permian period limestone, terra rossa, green igneous rock and alluvial strata. In the ore deposit there are both a layer-form deposit and a loose-rock deposit. The layer-form deposit is located at the western foot of the hill, with the rocks of the lower part standing exposed above the terra rossa. The deposit has a gradient of 20°. It originates in the standing rocks and has no continuations. It is a small deposit measuring about 10 meters by 7 meters, with an average thickness of 20 centimeters. And, the northern half of the ore body is admixed with limestone, so that it is coarse and poor ore. The ore in the southern half is a good grade, but it amounts to no more than about 20 tons.. The loose-rock deposit is of a very good grade, though lower than those at Mukden. The distribution of the ore rock is limited to the surface of the ground, where it is scattered very irregularly. There is not enough to permit even minimum mining operations, since the amount is estimated at about 30 tons.

(5) Conclusions

This ore deposit has but a very small amount of ore, and thus has no mining value.

2. The Povien Ore Deposit (Appended Figure No. 4)

(1) Name of Mine

None. The name of the nearby village of Povien was temporarily applied.

(2) Mining Rights

This ore deposit is in the following prospecting concession.

No. of Prospecting Concession	Name	Date Registered	Holder of Prospecting Rights
Cao Bang 1345	Kien Son	Mar. 18, 1940	Ngo Quang

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(3) Location and Communications

About 25 kilometers up the road from Cao Bang to Quang Uyen is a side road branching off; and about 400 meters north of this fork in the road is the village of Povien. The ore deposit is located some 2 kilometers north of the village. In between, there is only a trail running past sharp peaks of limestone. It has many grades, but they are not too extreme. However; the many outcroppings of limestone boulders and rocks make it very tiring just to walk: it is a bad trail,

(4) Geology and the Ore Deposit

The ore deposit is on the north slope of a Doline basin circumscribed by a very precipitous mountain area that is composed of Permian-period limestone. It is a loose-rock ore deposit occurring in terra rossa. The basin has been cleared and is terraced fields. The density of deposition in the deposit is greatest near the limestone on the north; but it gradually decreases down the slope from there to the south. The ore rock occurs only near the surface: in the main area of distribution the depth of the ore-bearing soil averages 0.5 meters. In other sections the ore is only on the surface. With such a depth of deposition, the ore deposit must be considered a surface deposit. Also, in some parts there are some limestone fragments admixed in the soil, in addition to the ore rock.

(5) The Ore Rock

The ore rocks are generally rounded and are mostly about the size of an oversized fist, or less. In the deposit there often are sections made up chiefly of small tubercle-shaped rocks less than wlanut size. They are hard and fine grained, and their fresh surface is steel-gray color with metallic lustre. The grade of the ore is good, each rock being about the same. The assay values are asffollows:

Serial No.	Mine of Deposit	O W	Fe	Mn	SiO_2	P	S	CaO	Al_2O_3	MgO	TiO_2
40	Povien Depos.	4.60	2.20	56.42	0.78	0.064	0.010	0.78	3.25	0.86	0.13
41	[illegible]	[illegible]	2.20	[illegible]	[illegible]	0.074	0.014	1.34	1.78	0.78	0.05
42	[illegible]	5.20	2.60	53.88	1.30	0.108	0.004	0.86	4.44	0.86	0.13

(Assay by Hachiman Foundry, 1942)

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(6) Amount of Ore

(a) Ore in the main area of distribution -

Total area $3{,}719m^2$

Part cropping out from the limestone and part not included in the ore rock in the topsoil is about 40%, so that the actual area of the ore deposit is:

$$3{,}719 \times 0.6 = 2{,}231m^2$$

Ore content/m^3 is 0.1-0.5 tons 0.2 tons average

Amount of ore is 446 tons, or about 450 tons

(b) Ore scattered outside the main area of distribution -

As the density of ore content is exceedingly irregular, the whole body is estimated at: 50 tons

(7) Conditions for Development

As this is a small ore body of no more than 500 tons of ore, it has almost no mining value by itself. But, the ore is good grade, and the mining would generally be easy, while at the same time the site of the deposit is not a great distance from the auto highway; nor is it far from Cao Bằng. Should it be developed as a part of the overall development of the manganese-ore producing areas in this region, it could serve to give some production.

Since, as already noted, there is but a poor trail over the 2.4 kilometers between the deposit site and the auto highway, it would take considerable expense to convert this into a horse-cart road. And, with the slight amount of ore, it absolutely would not support such an effort. Consequently, this trail should receive a minimal amount of improvement; and the hauling would have to be limited to using human power or pack horses. As the hauling capacity would be small, the amount of daily production would be quite limited. Now, computing the cost of hauling from the mine to Cao Bang:

Human or pack-horse hauling for 2.4km from the mine to auto highway		6.00 piasters
Hauling by truck to Cao Bang (including loading) - 25 km		7.50
	Total	13.50

Adding to this the shipping costs of 31.35 piasters from Cao Bang to Haiphong:

Shipping - mine to Haiphong 44.85 piasters

(8) Conclusions

This ore deposit is a loose-rock ore deposit in terra rossa covering a small Doline type basin in the midst of limestone mountains. And, it is a small ore body of no more than 500 tons. Its value for mining is almost to slight to mention; but it has a high grade of ore - about 54% manganese. And, the mining would generally be easy, and shipping the ore wouldbe comparatively simple. Thus, if it were to be developed in conjunction with the other deposits in this region, a certain amount of production could be realized.

In such circumstances the hauling of the ore from the mine to the auto highway would depend on relatively inefficient human power or pack horses, so that it would be difficult to increase daily production or to employ any methods for completing the operations in a short period of time.

3. The Lung Ri Ore Deposit (Appended Fig. 5)

(1) Name of Mine

None. The name of the nearby village of Lung Ri has been temporarily applied.

(2) Mining Rights

This ore deposit is in the same prospecting concession as the Povien ore deposit.

(3) Location and Communications

At a place about 26 kilometers from Cao Bang, off the main Cao Bang-Quang Uyen road on a side road to Quang Uyen, is the village of Dao Chang, And, the small village of Lung Ri is about 3 kilometers up a lateral valley northwest of there in the limestone mountains. The ore deposit is about 200 meters west of this village in the fields on the south slope of the valley. Between the minesite and Dao Chang is only a trail impassable to autos. The side road from Povien to Dao Chang is passable to both horse carts and small cars, but it is not suitable for general auto traffic.

(4) Geology and the Ore Deposit

The limestone in the vicinity of the ore depssit is from the Permian and Carboniferous periods. The ore deposit is a loose-rock deposit in the terra rossa which covers the valley. The ore rock consists of hard, fine-grained roundish rocks of fist size or less, or of small, granular tubercle-form rocks. The grade of the ore is good, but the deposit is small scale, with a small range of distribution. And, the ore rocks are deposited only to a depth of 50-60 centimeters in the soil near the surface of the ground. Thus, the density of deposition is coarse. One sample of the grade of the ore rock is as follows:

Serial Number	Name	C.W.	Fe	Mn	SiO_2	P	S	CaO	Al_2O_3	MgO	TiO_2
43	Lung Ri Deposit	4.56	3.00	53.24	1.42	0.132	0.004	8.80	4.17	0.69	0.14

(Assay by Hachiman Foundry, 1942)

The amount of ore is as follows:

(a) Ore in the main area of distribution -

Area		$2,750m^2$
Ore content/m^2		0.03 tons
Amount of ore :	82 tons, or	80 tons

(b) Ore outside the main area of distribution -

Estimated	20 tons
Total	100 tons

(5) Conclusions

This ore deposit has ore of good quality, amounting to some 100 tons - a small-scale deposit, and thus inconvenient for shipping. It is not worth mining.

4. The Lung Pao Ore Deposit

(1) Name of Mine

None. The name of the district has been temporarily appropriated for the ore deposit - Lung Pao.

(2) Mining Rights

This ore bed is in the same prospecting concession as the Povien and Lung Ri ore deposits.

(3) Location

One goes about 1 kilometer up a steep road among to mountains northwest of the Lung Ri deposit to reach a hollow called Lung Pao, in the midst of the limestone mountains. The manganese ore is on the west slope of this same hollow and extends to the south slope with occasional breaks.

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(4) The Ore Deposit

The ore deposit is a loose-rock ore bed deposited in the terra rossa. The distribution of the rock is very rough and irregular. The ore is mainly bean-size, kernel-shaped rocks. The amount of ore probably would not exceed several tens of tons.

(5) Conclusions

This ore deposit should simply be said to contain manganese ore; it is quite impossible to see this as being worth mining.

5. The Lung Riec Mine (Appended Fig. 6)

(1) Name of Mine

Called the Lung Riec mine.

(2) Mining Rights

This mine is in the following prospecting concession:

No. of Prospecting Concession	Name	Date Registered	Holder of Prospecting Rights
Cao Bang 1335	Lung Riec	Jul. 27, 1939	Poul Ferriece

(3) The Condition of Operations

This mine saw the initiation of mining operations in January 20, 1942. At the time of the survey, ten-odd natives were employed here, and small-scale open-cut stripping operations were being carried out under the supervision of an Annamese. The ore produced was said to be expected to be sold to Mitsui Bussan through the Frenchman G.B. Audet (a resident of Haiphong) as an intermediary.

(4) Location and Communications

Lung Riec village is across the paddies some 300 meters west of a point about 26 kilometers from Cao Bang on the Cao Bang-Tra Linh auto road. The ore deposit is located to the south of the village, at the foot of a hill bordering on the paddies. The deposit site, being near to the auto road, is convenient to transportation.

(5) Geology, the Ore Deposit, and the Ore Rock

The vicinity of the mine is made up of Permian and Carboniferous period limestone, with peaks rising steeply around a low, flat basin. The area around the basin is terra rossa, while alluvial deposits occupy the bottom of the basin.

In the ore deposit there are both layer-form and loose-rock ore deposits, though both are small in scale. The layer-form deposit has as its matrix the limestone of the foot of the mountain. The strike is N10°W, and the gradient is almost vertical. The thickness averages 30 centimeters, and 14 meters of the length is exposed. The southern end disappears into the earth, while the northern end is wedge shaped and tapers down to nothing. The loose-rock ore deposit is below the above-noted ore vein and occurs as less than puppy-size rocks deposited in the brown-black topsoil making up the terraced paddy fields. The ore-bearing earth is about 1 meter thick and is covered by 1 to 2½ meters of ore-free soil. The amount of ore contained in the ore-bearing soil is very irregular. From the evidence of the already mined part, the content appears to be no more than 0.1 tons per cubic meter. However, in order to obtain this, it is necessary first to excavate a large amount of the ore-free dirt.

The ore rock is a very porous black manganese oxide ore. But, a considerable amount of matrix rock, limonite and soil is oncluded with the ore rock, so that the grade is not good. The mined ore rocks are broken to about the size of a fist. And, even when this is carefully sorted one by one by hand sorting, the sorted ore has no more than 45% manganese. The unsorted ore must not be any more than 40% manganese. The grade of the ore by assay is as follows:

Serial Number	Name	C.W.	Fe	Mn	SiO_2	P	S	CaO	Al_2O_3	MgO	TiO_2
64	Lung Riec Mine	0.50	5.80	46.30	17.74	0.100	0.0055	2.50	0.54	1.17	0.10

(6) Amount of Ore

(a) Layer-form Ore Deposit –

Exposed length is 14m, but some continuation to the south is assumed:	20 meters
Thickness	0.3
Depth (Quality part not expected to run deep)	5.0
Safety factor - because deposit is intermittently thick and thin	0.7
Specific gravity of the ore	2.5
Amount of ore: 20 x 0.3 x 5 x 0.7 x 2.5 = 52.5T, or	50 tons

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(b) The Loose-rock Ore Deposit -

Area of deposit	$970m^2$
Avg depth ore-bearing soil	1 meter
Ore content/m^3	0.1 meter

Amount of ore: 970 x 1 x 0.1 = 97 tons, or 100 tons

(c) Ore located near the deposit

Estimate	10 tons
Total	160 tons

(7) Conclusions

This mine has a small amount of ore of a fairly low grade. And, though the mining would be easy, the loose-rock deposit is covered by ore-free soil, and there would be the great disadvantage of having to remove it. The sole point in its favor is its convenience to the auto road. This point, of course, would weigh heavily in favor of immediately starting to work the mine. However, present operations probably would not prove profitable because of the deposits lack of worth and quality. So, we see but little chance for the future development of the deposit. The future of the mine is clear when one notes the idle mines not far away.

6. The Lung Luong Ore Deposit (Appended Fig. 7)

(1) Name of Mine

None. Called Lung Luong temporarily, using the place name.

(2) Mining Rights

This ore deposit, as noted below, is in a prospecting concession owned by the Indo-China Mining Company, Ltd. (Taiwan Development). In the deposit there are a few prospecting pits dug under orders from the same company.

No. of Prospecting Concession	Name	Date Registered	Holder of Prospecting Rights
Cao Bang 1400	Cidim 10	Oct. 1, 1941	Indo-China Mining

(3) Location and Communications

This ore deposit is located about 2 kilometers northwest of Lung Riec village, mentioned above. Communcations are bad, with nothing but a steep, poor trail passing through the limestone mountains between the site of the deposit and the village.

(4) Geology and the Ore Deposit

The ore bed is dep sited in two separate locations, being in both cases loose-rock ore deposits in the terra rossa covering the slopes of a hollow between the limestone hills.

(a) No. 1 Deposit

This deposit stretches east and west along the east slope of the hollow. The ore rock os round pebbles of less than fist size and of good grade. But, the distribution is very irregular, so that according to what was learned from the prospecting pits in the deposit, the ore rock in effect is deposited only on the surface of the ground.

(b) No. 2 Deposit

This is located 300 meters south of the hollow of No. 1 Deposit in another hollow called Lung Luong. It is on the north slope of the hollow. In the deposit, on the upper part of the slope, the ore rocks are of large size and are deposited rather densely. Thus, the thickness of the ore-bearing soil is over 2 meters. On down the slope, however, the size of the ore rocks, the density of deposition and the depth of the deposit gradually decrease. Finally, the ore rock is deposited onyl on the surface. The ore deposited on or near the surface is hard, fine grained and of good grade (probably about 50%). But, that more than 1 meter below the surface is made up of very porous, sharp stones of "ore-rubble" form and containing limonite and limestone, so that the grade is rather poor.

The assay values for the ore are as follows:

Serial No.	Mine Deposit	C. W.	Fe.	Mn.	SiO_2	P	S	CaO	Al_2O_3	MgO	TiO_2
44	Lung Luong Dep.	7.65	6.80	44.38	5.14	0.091	0.011	1.31	5.93	0.60	0.17
45	"	7.03	3.20	48.70	5.70	0.064	0.004	1.00	5.63	0.95	0.22

(Assay by Hachiman Foundry, 1942)

(5) Amount of Ore

(a) No. 1 Deposit

Not closely surveyed. Probably no more than 20 to 30 tons.

(b) No. 2 Deposit

(1) Main area of ore distribution -

Area of deposit 1,100m^2

Depth of ore-bearing soil 1.5 meters

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Average ore content/m^3		0.11 tons
Amount of ore: $1100 \times 1.5 \times 0.11 = 181.5$ tons, or		180 tons
(2) Other than main area - Estimate		10 tons
	Total	190 tons

(6) Conclusions

In this deposit, the No. 1 Deposit has a small amount of ore, with no value for mining. The No. 2 deposit has even less ore, and would thus not be convenient for transporting. It has no value for mining.

7. The Ban Mac Ore Deposit (Appended Fig. 8)

(1) Name of the Mine

No set name. Called Ban Mac temporarily from the name of the nearby village.

(2) Mining Rights

This ore deposit is in the prospecting concession noted below.

No. of Prospecting Concession	Name	Date Registered	Holder of Prospecting Rights
Cao Bang 1378	Ngan Hanh	July 11, 1941	Nguyen Van Duoc

Trenches have been dug in this deposit for prospecting.

(3) Location and Communications

The deposit is north of Cao Bang near the China border at Ban Bac village, which is about 4 kilometers borthwest of Tra Linh village. The ore deposit is on a slope at the north foot of the limestone mountain to the south of the village. The road from Tra Linh to Ban Bac is not steep and is about 2 meters wide. But, since there are outcroppings of limestone in the road, it is impassable to vehicles and is barely passable to pack horses.

(4) Terrain and Geology

Ban Bac village is in a small lateral valley running from northwest to southeast. The hill area on the south side of the valley is made up of a steep peak of limestone. Near its summit is a sheer cliff. On the lower slope of the hill considerable terra rossa type soil is deposited.

Opposit this, the north side is chiefly phyllite, sandstone and clay-slate. According to the Cao Bang sector of the 500,000:1 and 1,000,000:1 geological maps, these rock strata all belong to the Devonian period "Schiste eifeliens a Spirifer Speciosus" layers. The mountain area near the deposit has few trees, being grass-covered hills. In the stream basin are alluvial layers; and the low land is mainly paddy fields.

(5) The Ore Deposit

The ore deposit is a stratiform ore deposit with limestone as the matrix. And, it is very non-uniform, with a marked widening and thinning down and bending of the matrix rock. As the vicinity of the ore deposit has a steep gradient, there has been no loose-rock deposit developed. The deposit occurs in the following four distinct areas.

(a) No. 1 Deposit

This deposit crops out on the southwest side of Ban Mac village. The strike is N30°E, and the gradient is to the northwest 60°. The ore body measures about 10 meters long by several tens of centimeters wide; but a large amount of impurities are included. The manganese content is probably around 20% - a low-grade ore with no part owrth mining.

(b) No. 2 Deposit

This deposit is at the north foot of a limestone hill some 200 meters south of Ban Mac village. Here an upper and a lower ore body crop out, each separate from the other. The lower ore body is in limestone rock projecting out of the terra rossa. It is 1 to 1½ meters wide and forms an S-curve matching the curve of the matrix rock. Its exposed length along the curve is 14 meters. The upper ore body has a strike roughly east and west and a gradient to the south of 55°. The length of the exposed head follows the slope for 3.5 meters, averaging 1.5 meters in width. (However, in the center there is limestone about 0.8 meters wide.) The grade of the ore is good in the exposed parts of both ore bodies.

(c) No. 3 Deposit

This constitutes three separate irregular, lens-shaped ore bodies at the north foot of the limestone hill, about 90 meters southeast of No. 2 Ore Deposit. The first measures about 2 meters long by 0.5 meters at its widest. It is manganese ore, with a comparatively large amount of hematite

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ore permeating into the limestone. The second is about four meters west of the first and up the hill from it. Being formed of manganese ore adhering to the fracture faces of the limestone, the ore shows a botryoidal [grape-form] structure on its surface. The third is again some five meters further west, an ore-permeation form of low-grade ore. These ore bodies are quite small scale, and the grade of the ore is not good.

(d) No. 4 Ore Deposit

This ore deposit is east of No. 3 Deposit about 150 meters, on the flank of a limestone hill. Across this deposit runs a prospecting trench, which reveals that the ore bed is deposited in the curved anticline part of some limestone and has generally the shape of a roof. On the lower base, limestone is exposed; but the limestone has largely dissolved away from the upper part, and the ore deposit is directly exposed on the surface, as well as being partly covered over by topsoil containing large amounts of rock fragments.

The south wing of the ore deposit has a strike of N70°W and a gradient of 60° to the south. Following along the cut face of the prospecting pit [trench] the ore occurs intermittently for about 12 meters. The thickness of the wide part is one meter. The upper part of the deposit is fine-grain good-quality ore. From about the middle downwards the ore body is intermittent and is made up of porous sharp pebbles; and it contains matrix rock, so that the grade is somewhat low.

The north wing of the deposit curves in a slightly wavy form, following a strike of N10-60°E, on a gradient to the northeast of 30°-45°. The length up and down the gradient is about 4 meters. The thickness is 1.3 to 1.8 meters. The lower partof the exposed part has been removed by erosion and does not extend underground. The grade of the ore is generally good. In the remaining part of the limestone overlying the ore deposit there is a zone of hematite and a silicated zone along the surface. The horizontal extension of this deposit along the axis of the anticline disappears into the ground. About 20 meters northwest of the ore bed is an outcropping that is considered to be a part of the south wing of the ore deposit. The ore in this part contains a large amount of matrix rock and is looked upon as low-grade permeation type ore. The parts worth mining in this horizontal

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extension cannot be estimated as large. Besides the above, in the bottom of the open trench loose ore rocks of about 1.5 meters in diameter appear from out of the earth.

(6) The Ore Rock

The nature and quality of the ore rock differ from deposit to deposit and from ore body to ore body. There is hard, fine-grained ore, soft, coarse-textured ore, porous ore, high-grade ore, low-grade ore with much matrix rock contained in it and ore containing a considerable amount of hematite. Below are given the assay values:

Serial No.	Deposit	C. W.	Fe	Mn	SiO_2	P	S	CaO	Al_2O_3	MgO	TiO_2
46	[illegible] Mine	6.79	7.60	50.88	2.00	0.000	Trace	1.17	0.63	1.15	0.10
47	"	8.89	8.90	44.60	3.60	0.145	"	1.61	1.12	2.97	0.09
48	"	6.94	16.00	38.02	1.30	0.075	0.030	0.81	0.57	2.26	0.08

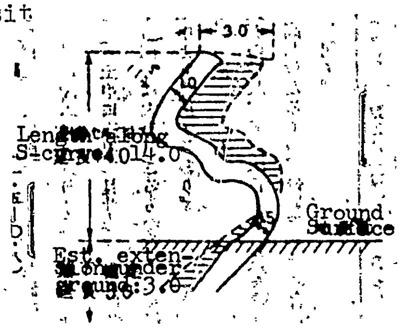
(Assay by Hachiman Foundry, 1942)

(7) Amount of Ore

(a) No. 1 Ore Deposit

No manganese ore worth mining.

(b) No. 2 Ore Deposit



(i) Lower ore body (S-shaped deposit)

Upper, no extension	Exposed part 14m) Est. underground 3m)	17 meters
Average width		1.2
Horizontal extension (est'd. average)		3
Specific gravity of ore		3.0
Amount of ore: $17 \times 1.2 \times 3 \times 3.0 = 183$ tons		180 tons

(ii) Upper ore body

Extension along the gradient	3.5 meters
Width (1.5 minus 0.8[limestone part])	0.7

Horizontal extension (estimated) 5 meters

Specific gravity of ore 3.0

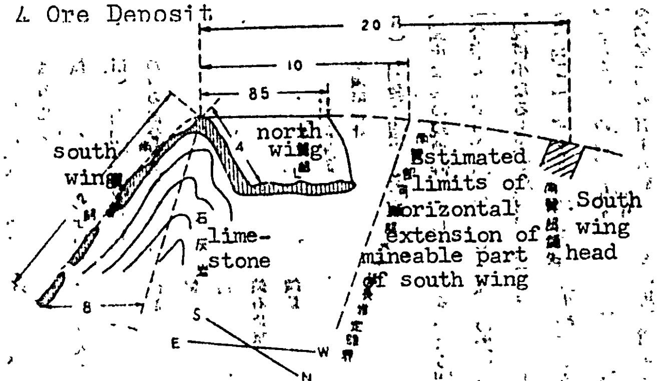
Amount of ore: 3.5 x 0.7 x 5 x 3.0 = 37 tons 40 tons

Total of No. 2 Deposit 220 tons

(c) No. 3 Ore Deposit

Just a few tons that can be treated as ore; not calculated.

(d) No. 4 Ore Deposit



(i) North wing

Horizontal extension (outcropping only, no underground extension) 8.5 meters

Vertical extension along gradient (also no underground extension) 4

Average thickness 1.5

Specific gravity of ore 3.0

Amount of ore: 8.5 x 4 x 1.5 x 3.0 = 153T 150 tons

(ii) South wing.

Estimated underground
(Exposed part: 8-meter base triangle -
(averaged to: 4 meters)
((refers to exposed part of)
(Estimated (north wing and northwest) 10 meters) 14 meters
(under- (20 meters of head of)
(ground (south wing)

Vertical extension along the gradient 12 meters

Average thickness (taken as ½ the maximum one meter thickness of intermittent lens-shaped bodies) 0.5

Specific gravity of the ore 3.0

Amount of ore: 14 x 12 x 0.5 x 3.0 = 252T 250 tons

(iii) Loose rock in bottom of trench

Estimated part in soil

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Length	4.5 meters
Width	1.5
Height	1.5
Specific gravity of ore	3.0
Amount of ore: 4.5 x 1.5 x 1.5 x 3.03 =	30 tons
Total of No. 4 Deposit	430 tons

Overall total of entire ore deposit: 650 tons

(8) Conditions for Development

This ore deposit, being in a remote location and having but a small amount of ore, would be difficult to work independently; and by developing in jointly with other ore deposits in this mineral region, it would be possible to turn out a small amount of ore. The possible objects of the operations are the No. 2 and No. 4 deposits. Both are layer-form deposits; but since the scale is small, they would not be worked by pit mining but rather by open-cut mining after excavating the topsoil to permit the digging. As for shipping the ore, of course from Tra Linh onwards truck transportation would be used. But, from the mine to Tra Linh the small amount of ore would preclude anything but hauling by horse cart. Consequently, the facilities and construction for transporting the ore should be chiefly a simple cable-waydown from the minesite to the foot of the mountain, a newly constructed 300-meter horse-cart road from the foot of the mountain to the Tra Linh-Ban Mac road, including a simple bridge across the stream, and some repairs along part of the Tra Linh-Ban Mac road to enable passage of the horse carts.

Now, the shipping costs from the mine to Haiphong are computed as follows:

Horse carts from mine to Tra Linh (4km)	1.50 piasters
Trucks from Tra Linh to Cao Bang (36 km) (including loading)	11.00
Shipping from Cao Bang to Haiphong	31.35
Total	43.85

(9) Conclusions

This ore deposit is a layer-form ore deposit of irregular shape, formed in limestone. While ore of good quality is included here, it is a small-scale deposit with barely 650 tons of ore. It would be difficult to work by itself, and should be developed in conjunction with the other ore deposits of the Cao Bang region.

8. The Toc-Tat Mine (Appended Figs. 9 & 10)

(1) Name of Mine

Called Toc-Tat mine.

(2) Mining Rights

This mine constitutes a mining concession and a prospecting concession:

Numbers of Mining and Prospecting Concessions	Name	Date Registered	Holder of Rights
None	Toc-Tat	Jan. 3, 1939	Bertrand Subira
Cao Bang 1316	Lung 0	Feb. 13, 1939	Nongich

(3) Location and Communications

About 12 kilometers east of Tra Linh on the Tra Linh-Trung Khanh Phu road is the village of Bang Ngan. The ore deposit is in the vicnity of Toc-Tat village (with only two houses), which is about 1.5 kilometers northeast of Bang Ngan. To go from Bang Ngan to Toc-Tat village one follows a trail from the road for about one kilometer through a hilly area. This path is barely wide enough for walking. The ore deposit is just about 7 kilometers from the China border, and there is no major obstacle to reaching the border in going northwest up the valley in which Toc-Tat village is located.

(4) The Present State of the Mine

This is an undeveloped mine, and the ore has previously been mined on an experimental basis from a part of the mine where transportation is relatively easy. At the present time part of the stored ore still remains at Bang Ngan village - about one ton. The rest [of the deposit] is still almost entirely untouched.

(5) Terrain and Geology

The terrain around the ore deposit is aged, generally moderately sloping hills, so that the hill tops are rather flat and the hills themselves are rather low. There are many limestone peaks. For the most part there are but few trees, with low reeds, shrubs and short grasses - showing a pastureland type of scenery.

The rock exposed above the ground is limestone only, found in one part of the hilly area and in just one place forming a very steep slope. The limestone is always distinctly layer form and occasionally includes very thin veins of quartzite. Any other rock is covered over by the yellow-brown soil so that the geological conditions are not known.

Since fragments of pale gray-yellow sandy shale rock with an exfoliated plate form is produced from the lower part of the prospecting pit in the loose-rock ore deposit on top of the hill, the strata covered by the topsoil would probably consist of this kind of rock.

The strike of the strata in the vicinity of the mine is roughly to the northwest and has been found to have a gradient to the northeast. According to the Cao Bang sector maps of the 500,000:1 and 1,000,000:1 geological maps published by the French Indo-China Geological Survey Bureau, the rock strata of this region belong to the so-called Ha Lang system of the middle Devonian period. In the valleys between the hills are alluvial strata. These, together with parts of the hills, have been cleared and developed into paddies and dry fields.

(6) The Ore Deposit

The ore deposit is laid down in several locations, both layer-form and loose-rock deposits.

(a) No. 1 Ore Deposit

This ore deposit lies exposed on the north side of a saddle area about 600 meters south of Toc-Tat on the trail from Bang Ngan to Toc-Tat. The ore bed is a loose-rock type and extends for 10-odd meters above the road and down to the valley floor. On the opposite side there is almost no ore rock. The ore rocks generally have many faces and angled edges; and there are a number of boulders the size of horses or cows. Very little of the ore extends underground, most of it being exposed above the surface.

The ore deposit shows the form of having recently finished breaking apart from the original layer-form deposit. The grade of the ore is generally good, but the deposit is not large scale.

(b) No. 2 Ore Deposit

This deposit is located on the ridge line of a flattened hill region of limestone about 400 meters northeast of the No. 1 deposit. Chiefly ore fragments of less than fist size are deposited in the top 30 centimeters of soil. The distribution area of the deposit is small; and, having an admixture of matrix rock, the ore is poor grade, so that only about half of the total amount would be worth using.

(c) No. 3 Ore Deposit

This ore deposit is on a small hill about 200 meters southeast of Toc-Tat village. It is a layer-form deposit, and a loose-rock deposit derived from it. The scale of the deposit is not large.

(i) The Loose-rock part

This extends from northwest to southeast along the top of the hill and is made up of ore rocks less than human-head size deposited in the yellow-brown soil. The data from the excavation of the prospecting pits in several locations around the deposit are as follows:

Prospecting Pit Number	Depth (meters) of ore-bearing soil	Ore content /m^3 (tons)	Detail
1	1.0	1.5	Heavy density near outcropping of ore vein
2	0.7	1.5	In ore body
3	0.8	1.2	In ore body
4	0.5	1.2	In ore body
5	0.7	1.5	In ore body
6	0.5	0.04	Edge of ore body
7		Small amount	Outside of ore body
8		None	Outside of ore body

From the data of Nos. 1-5 prospecting pits, the average depth of the ore-bearing soil is 0.7 meters and the average ore content per cubic meter of soil is 1.4 tons. The grade of ore is generally good. The vicinity of the deposit has a thick top soil, and there is no exposure of the bedrock. But, broken sandy shale is produced from the bottom of the layer of ore-bearing soil in the prospecting pits.

(ii) The layer-form part

This is deposited in the south center of the above loose-rock ore deposit. It is the last remnant of the ore body that supplied the loose rock deposit. It forms two lines of outcroppings, the east one having a strike of N60°W, a gradient to the east of 70° and dimensions of 6 meters long by an average of 1.3 meters wide, and the west one disappearing underground so that little is known about it except that it does not seem to extend very far. The ore along the exposed strike has plate-form fracture lines. In one part of the ore of the outcropping on the east there is very strong magnetism. The grade is poor compared with that of the loose-rock part.

(d) No. 4 Ore Deposit

This deposit is located near the southern end of the hill, about 200 meters southeast of the No. 3 Deposit. It is a small deposit of many puppy-size loose rocks collected on the middle flank of the hill, and groups of loose rocks deposited in a small area near the cliff bordering the dry field at the south end of the hill. The ore contains many bands of quartzite and hematite, as well as many other rocks, so that the grade is not good.

(e) The No. 5 Ore Deposit

This deposit extends northwest ~~to~~ and southeast from Toc-Tat village. Not only is it the largest deposit of this mine, but also it is the largest deposit in the whole Cao Bang region. In the center of the deposit is a single line of layer-form ore deposit. Around it is the loose-rock deposit derived from it. Within the bounds of the deposit are houses and a graveyard. To work the deposit, permission would be required.

(i) The layer-form part

This runs across the center of the loose-rock part on a strike of N45°W, and with a steep gradient. The outcropping runs from the southeast end to the northeast end of the houses, disappearing underground at each end. Along its length prospecting pits have been dug. The minimum length is 38 meters, while the width is 1.1 to 1.8 meters - averaging 1.5. The ore has flat, plate-like structure, and the grade is fairly good; but in one part there are other rocks and limonite admixed, so that the grade there is not good.

(ii) The loose-rock part

This is derived from the above layer-form part and extends northwest and southeast of the layer-form part. To the south, rocks are exposed here and there right up to the No. 3 Deposit. The ore is small boulders of less than humna-head size, and somewhat elongated. Most of it has flat, plate-like structure and is of a good grade compared to that of the layer-form deposit. The ore rocks occur on and in the gray-brown earth of the grass areas and dry fields. The thickness of the ore-bearing topsoil averages one meter. The ore content varies according to place from 0.2 to 1.2 tons per cubic meter.

(f) The No. 6 Ore Deposit

This ore deposit is located on top of a hill about 100 meters west by south of Toc-Tat village. It is a small-scale loose-rock ore deposit of irregularly scattered poor-grade orerocks in a small area.

(g) The No. 7 Ore Deposit

This ore deposit is about 750 meters northwest of Toc-Tat village, and is a layer-form ore bed formed in limestone on the east side of a site across a saddle in the trail to the vicinity of the national border. The strike generally is N15°W, and the gradient is to the west 30°-45°. The overall length is about 85 meters, with outcroppings at points within this. The thickness of the deposit increases here and there , but usually is 30-50 centimeters. In the wide part there are some variations in quality, but generally it is good. The ore has little resistance to erosion compared to the limestone, so that there are numerous cavities in the deposit. The ore deep in these cavities is of poor grade compared to that exposed on the surface of the ground, indicating that no expectation can be held for a major extension of the deep part of the ore deposit.

On the slope of the hill about 40 meters west of the northern end of the outcropping of this deposit the loose-rock deposit was once worked. We were told that a small amount of ore was duggfrom here experimentally. However, except for two or three tons ofoore in storage, there is now almost no evidence of that digging.

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(h) Other Ore Deposits

There is a mountain continuing northwest from the mountain where the No. 2 ore bed is deposited. On its ridge line and also on its middle flank there are three ore deposits. All three are loose-rock ore deposits of scattered ore fragments on or near the surface of the ground. Their scale is small, and they were not investigated in detail this time.

(7) The Ore Rock

The ore is generally fine-grained, mostly plate-form and somewhat fragile. It occurs both as a black, fragile and as a hard steel-gray manganese oxide ore. The first type generally predominates, and both types always show a striped [banded] structure. The grade of the ore in the case of the layer-form deposits is quite good, while in the case of the layer-form deposits the content of silicate, limestone and iron makes for a rather low grade. If these can be excluded, the grade would then be rather good. The following table shows the assay values:

Serial No.	Name of Deposit	C. W.	Fe	Mn	SiO_2	P	S	CaO	Al_2O_3	MgO	TiO_2
49	Too-Tat Mine	4.42	10.40	47.28	4.00	0.040	0.005	1.73	0.46	0.16	0.12
50	"	4.30	0.30	53.54	1.38	0.116	0.004	1.36	0.43	0.31	0.06
51	"	5.25	6.60	52.36	2.22	0.100	0.012	1.38	0.43	0.20	0.11
52	"	5.32	7.20	47.33	0.20	0.092	0.008	0.78	1.86	0.49	0.05
53	Too-Tat [illegible]	2.28	4.00	52.47	0.86	0.117	0.007	4.18	1.04	0.55	0.04
54	"	2.20	7.00	49.53	2.61	0.223	0.006	2.25	1.21	0.24	0.05
55	"	2.30	4.90	52.17	0.70	0.181	0.008	4.08	1.02	0.64	0.06
56	[illegible]	5.94	8.90	40.20	11.37	0.067	0.014	0.31	3.56	0.41	0.20
57	"	4.23	8.00	49.99	2.09	0.069	0.007	0.78	1.73	0.42	0.07
58	"	3.36	5.50	54.51	0.68	0.050	0.010	0.50	0.73	0.34	trace
59	"	4.30	6.10	53.21	2.04	0.054	0.016	1.10	0.99	0.35	[illegible]
60	"	2.53	7.20	47.20	42.32	0.050	0.005	2.42	0.46	1.05	[illegible]

(Assay by Hachiman Foundry, 1942)

(8) Amount of Ore

(a) No. 1 Deposit

Area of distributions (gradient of ore surface about 30°)		$1,323 m^2$
Average content of ore/m^2		0.8 tons
Amount of ore: 0.8 x 1323 =	about	1,060 tons

(b) No. 2 Deposit

Area of ore distribution	$656 m^2$
Average thickness of ore-bearing soil	0.3m

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Average ore content/m^3 of topsoil	0.4 tons
Exclusion of portion that is low grade	1/2
Amount of ore: $656 \times 0.3 \times 0.4 \times \frac{1}{2} = 39.36$,	or about 40 tons

(c) No. 3 Deposit

(i) Loose-rock deposit

Area of ore distribution (excluding area occupied by layer-form part)	$922m^2$
Avg thickness of ore-bearing soil	0.7m
Average ore content/m^3 of topsoil	1.4 tons
Amount of ore: $1.4 \times 922 \times 0.7 = 903.56$	about 900 tons

(ii) Layer-form part of deposit

Though its continuation underground is unknown, it is estimated at 1/3 of the size of the outcropping on the basis of what is known of the nature of the outcropping.

(a) Outcropping on the east

Horizontal extension	6m
Average width	1.3m
Depth (est. at 1/3 of 6m)	2m
Specific gravity of ore	3.0
Amount of ore: $6 \times 1.3 \times 2 \times 3 = 46.8$	about 50 tons

(b) Outcropping on the west

Horizontal extension	3.3m
Average width	1.0m
Depth (est. at 1/3 of 3.3m)	1.1
Specific gravity of ore	3.0
Amount of ore: $3.3 \times 1.0 \times 1.1 \times 3 =$ 10.89 tons	about 10 tons
Total for No. 3 deposit	960 tons

(d) No. 4 Deposit

Loose, puppy-size rocks on mid-flank of hill	3 tons
Group of loose rocks at bank on S. end of hill	10
Estimated amount underground	10
Total	23 tons
	about 20 tons

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(e) No. 5 Deposit

(i) Layer-form part

Horizontal extension	38 meters
Average width	1.5
Depth (continuation of deep part of ore vein is not known; however, 12 meters is the difference in elevation between south part of the ore bed and the valley floor; from nature of deposit, it is presumed to continue to ground level.)	12
Specific gravity of ore	3.0
Amount of ore (estimated)	
38 x 1.5 x 12 x 3.0 = 2052 tons	about 2,050 tons

(ii) Loose-rock part

As there is a difference in the ore content according to the part of the deposit, the computations are handled by sections.

Section	Area (m^2)	Thickness of ore-bearing soil	Avg ore content /m^3 topsoil (T)	Amount of ore (T)
A	281	0.8 meters	0.2	45
B	281	1.0	1.0	281
C	375	1.0	0.8	300
D	750	1.2	1.2	1,080
E	437	1.0	0.5	218
F	156	1.0	0.8	125
Totals	2,280			2,049 tons
			about	2,050 tons

Total for No. 5 Ore Deposit: 4,100 tons

(f) No. 6 Ore Deposit

As a small-scale deposit of poor-grade ore, this has no value for working and is not computed.

(g) No. 7 Ore Deposit

Horizontal extension of ore bed	85 meters
Average width of ore bed	0.4
Continuation of bed into strike of slope (Not known, but no large extension into deeper ground can be expected. Depth of cavities in bed and condition of ore deposit are taken into consideration.)	20
Specific gravity of ore	3.0
Amount of ore: 85 x 0.4 x 20 x 3.0 =	2,040 tons

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(h) Others: Three deposits northwest of No. 2 deposit

Since these were not surveyed, the amount of ore cannot be derived. However, the size of each ore body is not very different from those of the No. 2 Deposit, so that the amount of ore for all three ore bodies together would probably be under 100 tons.

Listing the above results, then:

Deposit Name	Loose-rock part of deposit (tons)	Layer-form part of deposit (tons)
No. 1 Ore Deposit	1,060	-
No. 2 " "	40	-
No. 3 " "	900	60
No. 4 " "	20	-
No. 5 " "	2,050	2,050
No. 6 " "	Very small amount	-
No. 7 " "	-	2,040
Others	Not computed, only small amount is anticipated.	-
Computed amount of ore	4,070 tons	4,150 tons

Total: 8,220 tons

The total amount of ore is computed at about 8,220 tons. Adding to this the ore in the unsurveyed deposits would probably give a figure not exceeding about 8,500 tons ~~[2xxxsixx]~~, which cannot be called large scale; but it is the largest of the manganese ore deposits surveyed in the Cao Bang region.

(9) Conditions for Development

As the total amount of ore does not exceed 8,500 tons, this deposit would not support large-scale operations, either. About half of the ore could easily be mined by open-cut stripping; but the remaining part - roughly half - is in layer-form ore deposits, which would require pit mining. As already discussed in Section II, the Tra Linh-Trung Khanh Phu road at present scarcely permits the passage of public buses, and it is not suitable for trucking the ore. Further, the thorough-going repair of this highway, including the bridge just in front of the Tra Linh garrison camp would cost a considerable sum, which would be completely incompatible with the known amount of ore in these deposits. Consequently, the transporting of the ore between the mines and Trung Khanh Phu should depend on nothing but horse carts. As there are no existing horse-cart roads between the mines and the Trung Khanh Phu road, or between the various scattered ore deposits, the existing trails would have to serve as the base for an improved network, which would be absolutely essential. Noting that there is now a level road running from Ban Ngan to the north part of No. 7 deposit, though it is somewhat roundabout, we believe it would be possible to reduce the cost of new road construction by hauling out the ore from the region by this road. The shipping costs from the mines to Haiphong are computed below:

Hauling by horse cart: mines to Tra Linh (16 km)	6.00 piasters
Hauling by truck: Tra Linh to Cao Bang (36 km)	11.00
Freight from Cao Bang to Haiphong	31.35
Total	48.35 piasters

(10) Conclusions

These ore deposits consist of ore beds deposited in a number of separate locations. The grade of the ore is generally good, being around 50% manganese. The amount of ore is estimated at 8,220 tons, which would run around 8,500 tons when the as yet unsurveyed deposits are added in. The deposit, largest in scale of any of the known Cao Bang manganese ore deposits surveyed this time, still has such a small amount of ore as to preclude large-scale works. About half of the total amount of ore is in loose-rock deposits which would be open-cut mined. The other half is deposited in layer-form beds, and most of it would require pit mining. The transporting of ore from the mines to Tra Linh would have to be limited to horse-cart hauling on the basis of the roads and the amount of ore.

9. The Ban Sac Ore Deposit (Appended Fig. 11)

(1) Name of Mine

None. Temporarily called Ban Sac after the name of the nearby village. The deposit is in the same prospecting concession as the Toc-Tat mine's No. 7 deposit; but since the mining and hauling work of the mine would have to be managed separately because of the terrain, this is dis-

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tinguished as the Ban Sac ore deposit.

(2) Mining Rights

No. of Prospecting Concession	Name	Date Registered	Holder of Mining Rights
Cao Bang 1319	Lung O	Feb. 13, 1939	Nongich

(3) Location and Communications

The deposit is no more than one to one and a half kilometers distant from the Toc-Tat deposits. But, between the two sites are precipitous peaks of tortured shapes. The deposit is about 100 meters northwest of the bridge across the Ha Vong River, about 16 kilometers from Tra Linh on the Tra Linh-Trung Khanh Phu auto road. On the south bank of the Ha Vong River is Ban Sac village. The deposit occurs in four separate locations northwest of the village. The trail from the vicinity of the bridge to the site of the deposit only suffices for foot traffic.

(4) Geology, the Ore Deposit, the Ore Rock and the Amount of Ore

The ore deposit occurs in a limestone hill area belonging to the so-called Ha Lang system of the middle Devonian system. The hill area bounded by the Ha Vong River is quite well wooded, but the deposit site is a grassy area, with the grass growing less than five feet high.

(a) No. 1 Ore Deposit

About one kilometer northwest of Ban Sac village is a small hamlet. The deposit is 200 meters beyond this hamlet, on the lower slopes of the limestone hill area of the right bank of the Ha Vong River. It is a loose-rock deposit occurring in the terra rossa of an upland field. It is said that in the past some ore was extracted from this deposit. The amount of ore in the deposit, not having been checked by this survey, cannot be given exactly, but the deposit's area of distribution measures about 70 meters by 40 meters; and the ore rock is simply scattered irregularly about on the surface. It would probably amount to several tens of tons. The ore is fine grain and hard, and is of a good grade.

(b) No. 2 Ore Deposit

Removed from the Ha Vong River, at a point 1.3 kilometers northwest of the Ban Sac village and about 300 meters up a steep slope is a small basin in the limestone hills commonly called Lung Nam. The deposit is a loose-rock deposit in the terra rossa of the northwest slope of the basin, and also a layer-form deposit on the upper part of that slope in the limestone.

1. The layer form part of the deposit

This constitutes several outcroppings here and there, each several meters long. Below the surface of the ground there seems to be a tendency for these to be linked up. Originally, it was one continuous ore bed, but most of it has already broekn away to form the loose-rock deposit.

The limestone constituting the matrix of this deposit is evidently a strata formation generally running on a strike close to east and west, and sloping to the north 5°-30°. However, in part it is irregularly curved and folded in a jumble. Between the east and the west limits of the outcroppings is a horizontal distance of about 45 meters, but within this there are breaks in the ore vein, so that the ore deposition amounts to about 1/3 of the distance. The thickness of the ore deposit is 30 to 70 centimeters - averaging 40 centimeters. The ore shows the same banded structure as that of the Toc-Tat mine. Though there is quite a content of silicate, the grade of the ore is generally good. The assay values are as follows:

SERIAL NO.	MINE OR DEPOSIT	C.W.	FE	MN	SIO_2	P	S	CAO	AL_2O_3	MGO	TIO_2
61	BAN SAC DEPOS.	3.35	8.50	52.51	1.38	0.059	0.005	0.70	0.79	0.37	TRACE
62	"	2.56	7.50	41.77	20.00	0.154	0.012	1.46	0.49	0.91	"

(Assay by Hachiman Foundry, 1942)

The amount of ore is as follows:

Overall length of the deposit	45 meters
Actual ore part of this - 2/3	30 meters
Average thickness of ore deposition	0.4
Length of extension on strike of slope	10
Specific gravity of ore	3.0
Amount of ore: 30 x 0.4 x 10 x 3.0 =	360 tons

2. The loose-rock part of the deposit

The deposit follows along the slope from northwest to southeast. Within the area of distribution of the ore are numerous limestone outcroppings, and many spaces where there is no ore. Here the gradient of the limestone is nearly horizontal, and the hill slopes have a gentle gradient, too. Only in a few instances are the terra rossa and ore boulders found in steeply sloping parts, mostly occurring on the level. The thickness of the ore-bearing soil is less than 80 centimeters, though this varies with the part of the deposit. In some cases the ore rock is simply deposited on the surface. And, there is considerable variation in the density of deposition, ranging from 0.1 tons to 1.5 tons per square meter. The larger figure especially applies to the northeast part of the ore body. The ore is generally of less than human-head size and always shows a banded structure. The grade is generally good.

The assay values are as follows:

SERIAL NO.	MINE OR DEPOSIT	C.W.	FE	MN	S_iO_2	P	S	CAO	AL_2O_3	MGO	TIO_2
63	BAN SAC DEP.	6.71	3.20	51.33	2.44	0.124	0.024	2.23	1.98	1.51	0.05

(Assay by Hachiman Foundry, 1942)

The amount of ore is as follows:

Total area of ore deposit	8,895m^2
Actual ore area, excluding ore-free area amounting to 30%	6,212m^2
Average ore content/m^2	0.4 tons

Amount of ore: 6,212 x 0.4 = 2,484.8 T, about 2,480 tons

The total amount of ore in the layer-form and loose-rock deposits is no more than 2,480 tons, which must be called a small deposit. But, among the manganese deposits of the Cao Bang region, it is an amount of ore to be considered.

(4) The No. 33 Deposit

This is a loose-rock manganese ore deposit of good grade occurring in the terra rossa of a field near the head of a valley that runs down to the northwest from the saddle area at the northwest edge of the No. 1 deposit. As this was not surveyed, the amount of ore cannot be stated exactly; but the area of distribution is quite wide, and the ore rock is rather densely deposited. The amount of ore should run to several hundred tons. On down the valley in which this deposit is situated the slope is generally gentle down to the banks of the Ha Vong River. From the saddle at the head of the valley to the Ha Vong River is about 300 meters.

(5) No. 4 Deposit

This is bounded on the west by limestone hills of the Lung Nam basin in which the No. 2 deposit is located. It is in a separate basin on the opposite side and is commonly called Lung Sang. The deposit is one of

Serial	Mine of Deposit	C. W.	Fe	Mn	SiO_2	P	S	CaO	Al_2O_3	MgO	TiO_2
63	Ban Sao Dep.	6.71	3.20	51.33	2.44	0.124	0.024	2.25	1.98	1.51	0.05

loose rock, occurring in three separate sites near the bottom of this same basin. All are very small scale, and the ore is poor grade.

(6) Conditions for Development

Of the four deposits, Nos. 1 and 4 do not merit being called ore deposits and have no value for mining. Those which can be the objects of mining operations are No.s 2 and 3. However, both contain but a small amount of ore and would permit but small-scale works. The mining could easily be carried on as open-cut stripping. As for the layer-form part of No. 2 Deposit, this is small and should only be worked by open-cut digging near to the outcroppings.

To haul out the ore, the arrangements would be just as at the Toc-Tat mine - horse carts to Tra Linh. Hauling via the road from Tra Linh to Trung Khanh Phu is a somewhat roundabout route, but the next best choice would be to go to the road near Ban Sac, about 2 kilometers away. And, to construct a horse-cart road, the trails already there would have to be improved. The shipping costs from the mines to Haiphong are as follows:

By horse cart from minesite to Tra Linh (18 km)	6.50 piasters
Truck shipping, Tra Linh to Cao Bang (36 km)	11.00
Shipping from Cao Bang to Haiphong	31.35
Total	48.85 piasters

(6) Conclusions

This deposit is divided into four distinct sites. Of these, two are not worth calling ore deposits and have no mining value. Of the remaining two, one has 2,480 tons of ore, and the other probably several hundred tons. These are small-scale deposits; but should they be developed in conjunction with other deposits in this manganese-ore producing region, they would be worth some consideration. The grade of the ore is generally good, about 49% manganese. The mining would be an easy operation, since open-cut mining would be possible. The hauling out of the ore would be by horse cart for the approximately 18 kilometers from the mines to Tra Linh.

10. The Hung Mine (Appended Fig. 12)

(1) Name of Mine

Called the Hung mine.

(2) Mining Rights

This mine is in the following prospecting concession:

Name of Concession	Date Registered	Holder of Mining Rights
Hung	January 3, 1939	Bertrand Subira

(3) Location and Communications

This mine is in the hills east of the Quang Uyen-Trung Khanh Phu road, about 11 kilometers north of Quang Uyen. From the auto road to the foot of the hill is just about 250 meters of level terrain, so that communications and transportation would be convenient.

(4) History and Present Status

This mine was an operating mine several years ago and now is under the management of the Frenchman Subira. Previously, some of the ore was sent to Haiphong and sold to a Japanese firm. When the mine was first opened, the loose rock at the foot of the hill was mainly worked, but later they took up the mining of the outcropping part of the layer-form deposit. Now almost all parts mineable by open-cut stripping are nearly mined out. Several months ago they began digging shafts. There are now six shafts from which the deposit is being worked; but for the most part technological considerations have been neglected, and they have simply dug out an irregular sloping shaft from the outcropping. After they have dug along several tens of meters more, they will begin to cause difficulties for the further extension of the shaft. In pushing along the shaft, they have used explosives and thus have had to install many side beams. For working in the shaft under these special conditions, they have said, trained miners will be brought in from the Hongay coal mining area. As for facilities at the mine, there are just two houses for the mine formen, a small blacksmith's shop, an explosives shed and one ore-storage warehouse. There are no mechanical facilities at all. The ore produced is chuted down to the foot of the hill by using the natural gradient of the hillside, and is hauled by human power to the storage point beside the auto road. At present, there are about 250 tons of very high grade ore in storage at this depot. The ore is carried in woven baskets of bamboo and taken via Cao Bang, Na Cham and Phu Lang Thuong to Haiphong. At the time of the survey few miners were working since it was just before the New Year holiday by the lunar calendar; but normally about twenty miners are said to be on the job. Management at the mine is entrusted to an Annamese; and no Frenchmen are locally resident.

(5) Reference

There has been the following survey report by a Japanese technician:

Horikoshi, Giichi: Report of Survey of French Indo-China Mines and Ore Deposits, "Hung" Manganese Mine; deposited with the Taiwan Development Company. Ltd. (A survey of 1941).

(6) Terrain and Geology

The mountain area where the ore is deposited has an elevation of 140 meters, and the slopes are very steep. There are almost no trees and just a few shrubs and a little grass. However, on the four nearby hills there is some forest, so that the shaft beams needed for small-scale mining operations would not be too hard to obtain. The hills in which this ore bed is deposited are chiefly limestone which includes thin bands of quartzite. Farhter down the hills, the amount of quartzite gradually increases until the limestone and quartzite together form banded strata less than several tens of centimeters thick. And, then finally the strata become mainly quartzite. The form of the hills also gradually changes along with the rock, with sheer slopes of limestone in the north gradually becoming more moderate toward the south. According to the geological map published by the French Indo-Chinese Government, the flatlands at the foot of this hill and mountain area are an alluvial development.

(7) The Ore Deposit

This is a layer-form deposit contained in quartzite, which in turn is included in the limestone. Together with the strata, it slopes gently to the north; and it is exposed from the south face of the hill to the west slope. The deposit increases and decreases in size without any

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regularity. The grade of the ore varies greatly, with the high-grade part distributed in rope-like formations and the rest containing quartzite, iron ore and limestone. Ten-odd meters away from the outcropping is the mine shaft, Comparing the condition of the ore in the shaft and in the outcropping, the deeper one gets the lower the grade of the ore. But, gradually the ore becomes a vein, giving rise to the expectation of a large continuation of the deposit in the deeper parts.

The deposit is divided into the following three parts:

(a) No. 1 Ore Deposit

Located at the extreme north end and cropping out on the west slope of the hill. The strike is N60°-70°W, with part of it N45°W. The gradient is 25°-40° to the northwest. It is about 110 meters between the two ends of the outcropping; but within that length the ore deposit widens and narrows intermittently as irregular, lens-shaped sections. The actual deposition of ore amounts to about one half of the total length. The ore deposit is very thin in places, but the parts worth consideration are 40 to 50 centimeters thick. Occasionally this reaches 90 centimeters, but most of such parts contain quartzite and hematite.

(b) No. 2 Ore Deposit

Located about 15 meters down from the No. 1 deposit, this deposit looks as if it had been cut off from the other by a fault. The strike is N60°-80°E, and the gradient is to the northwest 15°-30°. The dimensions are 30 meters long by 40 centimeters to 2 meters thick; but the thickness in the larger parts includes quartzite. The thickness adequate for actual working averages 50 centimeters.

(c) No. 3 Ore Deposit

This deposit is exposed on the south slope of the hill and is derived from almost the same horizon as the No. 1 deposit. There is a gap of about 90 meters between the two deposits. The strike is N60°-80°W, and part of it is N80°E; the gradient is to the north 20°-45°. The length is 80 meters, but within this length the ore frequently becomes either very/~~thin~~ narrow or is totally interrupted. About 2/3 of it actually could be worked. The thickness of the deposit is 30 to 40 centimeters.

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In the terra rossa soil covering the hill that extends eastward about 400 meters from the hill where the ore is deposited there are many sites of manganese ore deposition. These have seen considerable prospecting, but the ore rock is very roughly admixed into the soil to a depth of 2 or 3 meters and has no mining value.

(8) The Ore Rock

The ore rock is chiefly accumulations of boulders of manganese oxide ore (pyrolusite), non-crystalline granule-form rock that is either black ore steel gray with metallic lustre. Occasionally it is breccia form or "ore-rubble" form. Generally it is soft and porous. Also, it is sometimes found in long pillar-form structure which is gray-black with metallic lustre, or in the fish-scale form of soft manganese ore crystals. In part of the matrix rock of the deposit there is occasional fine-grain hematite. There is red-brown iron-bearing quartzite, and in such parts there is quite a bit of hematite and limonite ore contained. And, in the deposit there is also fine-grain, lead-colored quartz and a thin vein of calcite. The ore presantly in storage in the depot is of very good grade, but that remaining in the deposit is low grade, according to the level; and the quality also varied according to location. The part worth mining is jumbled.

The assay values of the ore rock are as follows:

Serial No.	Mine of Deposit	C. W.	Fe	Mn	SiO_2	P	S	CaO	Al_2O_3	MgO	TiO_2
65	Hong Mine	1.62	4.30	41.73	9.00	0.153	0.005	5.60	0.75	0.75	0.10
66	〃	3.06	6.00	45.12	8.32	0.289	0.005	2.40	0.90	0.71	0.10
67	〃	2.73	7.20	49.70	0.97	0.289	trace	2.00	0.74	0.99	0.06
68	〃	2.50	8.50	42.16	5.74	0.523	0.006	7.00	0.09	0.45	trace
69	〃	1.91	7.20	44.42	7.76	0.248	trace	6.00	0.81	0.55	0.05
70	〃	2.06	6.70	44.83	7.70	0.283	0.006	2.00	0.85	1.15	0.10

(Assay by Hachiman Foundry, 1942)

(9) Amount of Ore

The survey of the deep parts of the deposit has not been adequate, so that it is difficult to estimate the amount of ore accurately. But, estimating from current conditions, the amount is as follows:

In the terra rossa soil covering the hill that extends eastward about 400 meters from the hill where the ore is deposited there are many sites of manganese ore deposition. These have seen considerable prospecting, but the ore rock is very roughly admixed into the soil to a depth of 2 or 3 meters and has no mining value.

(8) The Ore Rock

The ore rock is chiefly accumulations of boulders of manganese oxide ore (pyrolusite), non-crystalline granule-form rock that is either black ore steel gray with metallic lustre. Occasionally it is breccia form or "ore-rubble" form. Generally it is soft and porous. Also, it is sometimes found in long pillar-form structure which is gray-black with metallic lustre, or in the fish-scale form of soft manganese ore crystals. In part of the matrix rock of the deposit there is occasional fine-grain hematite. There is red-brown iron-bearing quartzite, and in such parts there is quite a bit of hematite and limonite ore contained. And, in the deposit there is also fine-grain, lead-colored quartz and a thin vein of calcite. The ore presantly in storage in the depot is of very good grade, but that remaining in the deposit is low grade, according to the level; and the quality also varied according to location. The part worth mining is jumbled.

The assay values of the ore rock are as follows:

SERIAL NO.	MINE OR DEPOSIT	C.W.	FE	MN	SIO_2	P	S	CAO	AL_2O_3	MGO	TIO_3
65	HUNG MINE	4.62	4.30	41.73	9.90	0.153	0.005	5.60	0.75	0.75	0.10
66	"	3.05	6.90	45.12	5.32	0.289	0.005	2.40	0.90	0.71	0.10
67	"	2.73	7.20	49.70	0.97	0.289	TRACE	2.60	0.74	0.99	0.05
68	"	2.50	8.50	42.15	5.74	0.523	0.005	7.00	0.69	0.45	TRACE
69	"	1.91	7.20	44.42	7.76	0.248	TRACE	6.00	0.81	0.55	0.05
70	"	2.66	6.70	44.83	7.70	0.283	0.005	2.60	0.85	1.15	0.10

70 2.66 0.70 44.83 7.70 0.283 0.005 2.60 0.85 1.15 0.10

(Assay by Hachiman Foundry, 1942)

(9) Amount of Ore

The survey of the deep parts of the deposit has not been adequate, so that it is difficult to estimate the amount of ore accurately. But, estimating from current conditions, the amount is as follows:

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(a) No. 1 Ore Deposit

Total length	110 meters
Within this, part where ore is deposited (x 1/2)	55 meters
Average thickness	45 cm
Depth (Considered 1/3 of the length on basis of ore deposit and ore rock)	18 meters
Portion of ore within deposit that is worth mining) Portion of ore remaining after sorting)	30%
Specific gravity of ore	3.0

Amount of ore (estimated mineable)

55 x 0.45 x 18 x (1-0.3) x 3 = 935.55T, or

about 900 tons

(b) No. 2 Ore Deposit

Length	30 meters
Average width	0.5
Depth (Considered ½ of the length)	15
Portion of mineable ore, excluding poor grade ore) Portion of ore remaining after sorting)	40%
Specific gravity of ore	3.0

Amount of ore (estimated mineable)

30 x 0.5 x 15 x (1-0.4) x 3 = 395T, or 400 tons

(c) No. 3 Ore Deposit

Total length	80 meters
Within this, portion of ore deposition (x 2/3)	53
Average width	35 cm
Depth	18 meters
Portion of ore worth mining) Portion of ore remaining after sorting)	30 %
Specific gravity of ore	3.0

Amount of ore (estimated mineable)

53 x 0.35 x 18 x (1-0.3) x 3 = 701.19T, or

about 700 tons

Total for whole mine - est. mineable: about 2,000 tons

(10) Conditions for Development

The amount of ore is estimated at no more than about 2,000 tons. Even if more deposits are discovered in the future, the amount of ore absolutely cannot be expected to be large; and mining, in view of present conditions cannot be expected to advance markedly. Japan Mines has already almost completed working the open-cut part where the mining is easy and the ore good. In the future, the mining must be from pits, so that conditions will get worse and the grade of the ore will basically be low.

Mining in the past has been very makeshift; in the future it will be necessary to carry on planned mining. For this purpose, thought must be given to mining, drilling an access shaft ten-odd meters below the outcropping. For transporting facilities, a single, simple cableway from the shaft entrance to the foot of the hill would be installed. And, the repairing of the road from the foot of the hill to the auto road would just about take care of it.

Shipping costs from the mines to Cao Bang are computed as follows:

Trucking from mines to Cao Bang (48km)		14.50 piasters
Cao Bang to Haiphong		31.35
	Total	45.85

(11) Conclusions

The main parts of the ore deposits of this mine are layer-form deposits that have thin quartzite strata as the matrix, this in turn being included within limestone. The amount of ore surveyed was no more than 2,000 tons; but this is one of the largest known manganese ore deposits surveyed this time in the Cao Bang region. The mine is presently being worked on a small scale; and it has the strong point of the ore being generally easy to haul out. In the future, too, it will have continuing value. Hereafter, it will be urgent first of all to initiate planned mining. But, since we cannot count on the deeper extension of the deposit being large, we absolutely cannot hold hope for a large amount of ore. In the past, the high-grade ore of over 45% manganese which could be easily worked by open-cut stripping has been mined, but this is now exhausted. Hereafter, less favorable mining conditions in the pit operations will

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prevail; and the ore extracted will fall to a grade of about 40%. Thus, it will become appreciably less advantageous to work, as compared with in the past.

[Omitted Chapter VII, per instructions]

CHAPTER VIII

MANGANESE ORE DEPOSITS AND QUARTZITE VEINS CONTAINING IRON PYRITE IN THE VICINITY OF NGAN SON, BAC KHANH PROVINCE, TONKIN STATE

Period of Survey	December, 1941	
Surveyors	General Mining Team	
Team member	Engineer, Taiwan Gov't-Gen'l	Shunkichi Takahashi
Same	Deputy Chief, 1st Section Mitsui Mining Co., Ltd. Dr. of Physics	Sadaichi Tokuda
Same	Secretary, Mitsui Bussan Company, Ltd.	Yuin Chiba
Assistant	Ass't. Engineer Taiwan Government General	Shomei Haruda
Same	Staff, Mitsui Mining Co., Ltd	Kenkichi Yamamoto
Interpreter		Kaneo Higuchi

Section 1. Preface

The vicinity of Ngan Son has been known since long ago as a mineral area for silver, lead and other metals; and more recently the discovery of manganese ore and iron pyrite ore has become known. And, Japanese trading companies have become concerned in them. All members of the General Team for Mining had determined to tour this region; and, if peace and order were not prevailing, to leave Cao Bang on the border, go around Lang Son and survey the antimony of Dong Ken. Thus, after the

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survey of the Lao Kay phosphorus mines by our Takahashi team (returning to Hanoi on January 16), we joined Mr. A. Røsario, the mine foreman, and Mr. Sato of Taihei Mining Company, with which Mr. Røsario is connected, and left Hanoi on the 22nd to carry out the survey. But, we heard all sorts of reports about the border area, this being right after the outbreak of the Great East Asia War; so we gave it some deep thought and unanimously decided to give up the inspection tour of the Cao Bang-Lang Son region and stay in Hanoi.

As a result of further consultation and discussion, it was decided to undertake the survey of the Ngan Son manganese ore deposits.

The mines and ore deposits surveyed were:

(A) The so-called manganese mine of the Møb concession, Nanoi village.

(B) Silver, lead and zinc ores in the vicinity of Ngan Son, said to be associated with the interpreter, Kikuike.

(C) Gold-bearing (?) quartz veins containing iron pyrite ore in the Nic concession near Ngan Son.

(D) Pyrite ore and silver and lead veins in the Nic concession near Ngan Son.

(E) Silver and lead veins in the Nic concession in the vicinity of Ngan Son (Those with which Mr. Kikuchi is said to have an association).

(F) The Mo-Linh-Nahi Mine

(F) was omitted, having been surveyed in detail by the iron ore team.

For some time, Mr. Røsario has had a personal association with six inidividual concessions in this vicinity:

Concession Number	Concession Name	Kind of Ore
984	Møb	Manganese .... (covered in [A])
985	Bibi	Manganese and calamine
988	Lunette	Silver, lead and calamine
989	Kemat	Wolframite
982	Nic	Silver, lead (covered in C & D above)
983	Noune	Silver and lead

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We had been requested to survey all of these this time, but we indicated our desire to omit those not yet being developed. Therefore, we planned only for a survey of part of these: the two concessions and three ore deposits under Numbers 982 and 984. Thus, we do not know whether or not one ore deposit under Mr. Kikuchi's plan belongs in Rosario's (C) concession.

Diary of Activities:

Dec. 17-21 Preparing data from the Lao Kay phosphorus mine survey; at same time, preparing the survey of the Ngan Son area.

Dec. 21 Left Hanoi, arrived at Nanoi. Had hoped to do the survey this day, but arrived at Mob concession just at sundown. Still, following our projected schedule, we hurriedly entered the concession, surveyed it and stayed the night. (This was because Mr. Rosario was late, showing up at 10 o'clock instead of at eight as promised.)

Dec. 23 Left Nanoi early in the morning and went to Ngan Son to see the above (B), (C) and (D) ore deposits.

Dec. 24 From various information we learned that tours of Cao Bang were being stopped. So, we went back to Nanoi and again surveyed the Mob concession, giving it a thorough survey, because of the cursory nature of the previous survey. After that, we left Nanoi and went to Thai Nguyen, where we met the Oe group of the Iron-ore Team and stayed over night.

Dec. 25 Following the plan of the Taiwan Development Company, we shifted to a survey of all the iron mines at Mo Linh Nam, then leaving Thai Nguyen and returning to Hanoi.

Section 2. The So-called Manganese Ore Deposit of the Mob Concession

(1) Location and Communications

The Mob concession is at Nanoi village, Ngan Son County, Bac Kang Province, Tonkin State. It is on the auto highway from Hanoi to Cao Bang, about 250 kilometers from Hanoi. There is no railroad going there, nothing but the highway; and it must be said to be inconveniently located deep in the mountains.

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Reference: Hanoi - Na-Noi 205 kilometers (auto)

Thai Nguyen - Na-Noi 130 kilometers (auto)

Na-Noi - Ngan Son 16 kilometers (auto)

(2) The Concession

Registry No. 984 (Approval recently confirmed for the concession)

Concession Name: Mộb

Rightholder: A. Rasario (198 fis Rue Armand, Russeau, Hanoi)

Kind of mine: Called manganese, actually limonite ore

While approval was being sought, prospecting had been going forward at the same time.

Persons associated:

(a) A. Rasario (nominal person and operator)

(b) Taihei Mining Co., Ltd.) Said already to have

(c) Shimomura Overseas Operations,) earned ¥14,000 in profits.
Mr. Riju Shimomura

(b) pays (a) 70% of the ore price on the basis of an analysis of production and shipping; and after arrival of the ore in Japan, the balance is paid, so we were told.

(3) Terrain

The terrain of this vicinity is generally rugged east of Bac Kang, so that autos have to cross high passes. The vicinity of Nanoi is a so-called youthful mountain region, and there is little flatland in the valleys for paddies, most of these occupying the slopes. And, villages are rare. The nearby Mt. Nanoi rises 950 meters above sea level.

The ore deposit is exposed about 500 meters above sea level. The outcropping is in a zone of jungle near the summit on a steeply sloping mountain side.

(4) Geology

According to a French Indo-China survey group, this vicinity is developed from limestone belonging to the Silurian and Devonian periods, covering a fairly broad area. In the area surveyed there is limestone with clay-slate interposed between, this forming the cliffs and shoulders of the mountains. But, the metamorphosing effects of igneous rock here seems to have been slight. And, the crystals in the limestone are very fine.

(5) The Ore Deposit

The ore deposit is believed to be a type of gangue-form deposit cutting obliquely across the above strata, as discussed below. According to the explanation of such a person as the mine foreman, this mine is manganese ore. And, the ore in the weathered strata in the limestone is understood to be admixed in a loose-rock form, with plans for its development being pushed forward. However, according to the way we see it, this ore should be distinguished into the following three kinds:

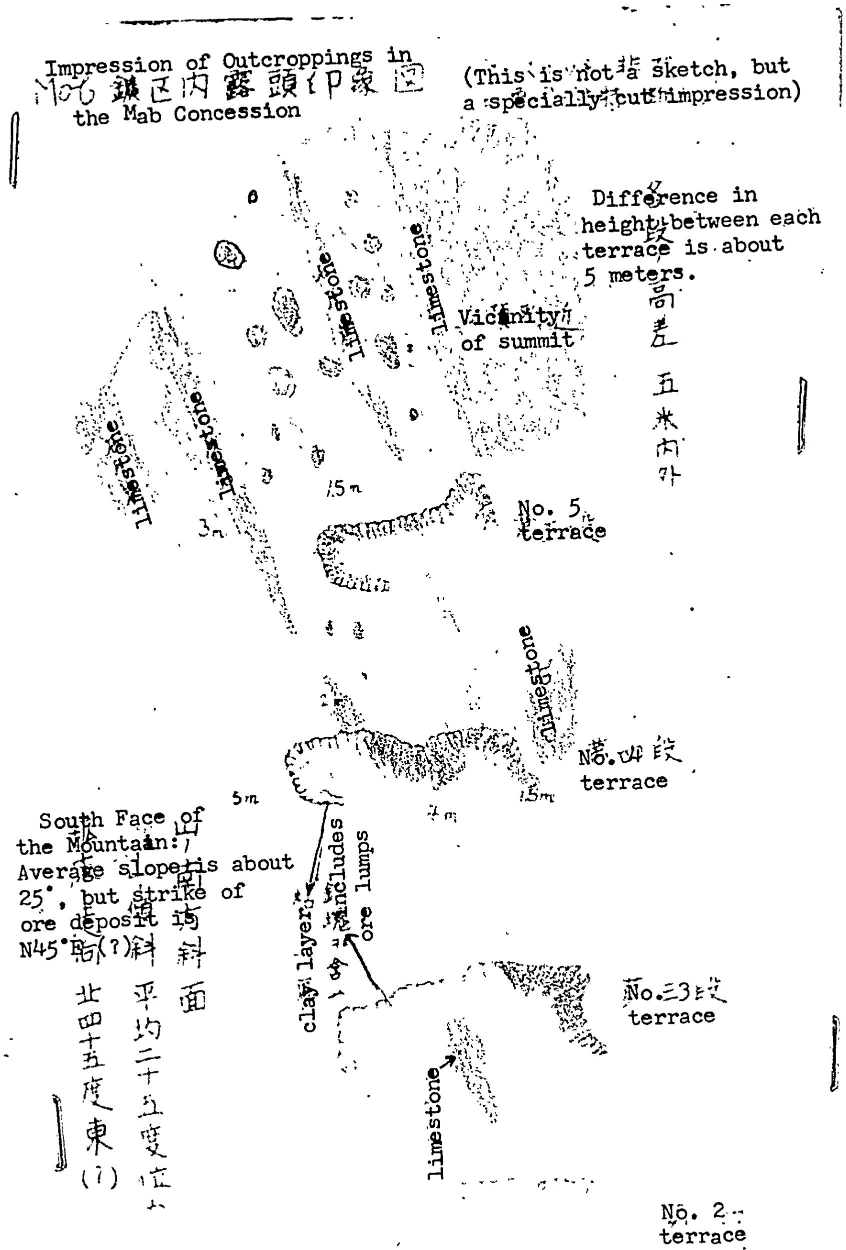
(a) One meter or less of small pebbles in the strata, taking a loose-rock form (from one to two meters below the surface).

(b) Large pebbles which seem to have a base [original deposit?] and which digging proves to be a part of a vein (with a thickness from about 2 meters up to more than 10 meters).

(c) Large rocks on the summit lying about loose, their size sometimes reaching two to three meters. Here, rather than mere loose rocks, we can recognize the end of an outcropping (however, with loose rocks associated with it).

Thus, this deposit is not just a loose-rock deposit, for by digging its roots become known, confirming the existence of an ore vein. The clay strata near the surface of the ground are a kind of weathered limestone containing loose rocks of ore that have broken off and fallen into it. When this was dug into, strangely shaped limestone shafts could be seen. These are understood to be one form of a remnant terrain that has been covered up. The region of loose rock, as shown on the supplemental [appended] charts, generally extends to within about 200 meters of the summit; and prospecting is going on, making a "gradan" [phon. approx.: quotation marks are in text] by excavating the steeply sloping part at the southern end.

Since the area of the summit has not yet been excavated, there is a considerable area whose actual nature is not known.



Observing the part exposed by the present terracing, the part considered to be an ore vein (corresponding to [b] above) has a maximum thickness of 13 meters, a strike of north by east, a perpendicular gradient and an extension (including [c] above of more than 200 meters in two or three layers. There are all kinds of variations within this, so that there is nothing to do but await further excavations hereafter.

(6) Concerning the Limonite not believed to be Manganese

Next in importance is the quality of the ore. The operators all believe it to be manganese (calling the grade 45 to 50%); and the mined ore is rapidly being hauled out by ox cart and boats. But, last September 18, this team's group member Chiba inspected this mine on the request of the Mitsui Bussan Company; and he explained to Rasario that it is not manganese ore. The present data gives the following results from the assay of the government's Mining Bureau:

SiO_2	1.2 %
Fe	49.16
Mn	13.70
Fe & Mn (Wolframite)	62.86

However, Rasario, believing this to be manganese, is indignant at the refusal of Mitsui Bussan to purchase the ore. (We later heard that the ore this man took to the Mining Bureau was first assayed at 40% manganese.) This time we also surveyed other deposits and looked into this case directly; but the result was that we still do not recognize this as manganese ore. It must be recognized as mostly limonite. Nevertheless, since Rasario was so indignant, we admitted some room for doubt and had Mr. Sato re-assay it and report the results again to Rasario. Since then, the Taihei Mining Company had not yet received the results, but it has no doubt but that it is iron ore, having hear the results of the assay at Hanoi, Haiphong and Japan

(6) [sic] The Matter of the Iron Ore Believed to have Metamorphosed from Iron Pyrite

We learned that there have been several instances of finding iron pyrite (iron sulfide) remaining in the center of the ore boulders inspected at the deposit. This fact caused us to infer directly that this iron ore was metamorphosed from iron pyrite. And, the fact that the perimmeter of the pyrite ore shows the "risegang" [phon. approx. - "lisegang" or "liesegang" would also be possible renditions] type of ring formation attracts attention to the explanation of a metamorphosing process. Therefore, in the deeper part iron sulfide ore is deposited. (In French Indo-China there are such examples of limonite ore formed from iron pyrite ore. Also, zincblende becomes calamine in the deeper parts, and stibnite turns mostly into valentinite - similar kinds of phenomena).

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(7) The Amount of Ore

In its upper, weathered (oxidized) zone, this ore deposit is limonite, and the lower, or inner part is iron sulfide ore. Thus, it is difficult to expect a large amount remaining as iron ore. Thus, we feel that with the inconveniences of shipping taken into consideration, too, there would be no point in computing the amount of ore.

Now, as for the amount of pyrite ore in the deeper parts, the weathering is quite severe since in French Indo-China the weathering effects penetrate to quite a depth, this being due in part to the high elevation of the ourcropping in this present case. As for the question of the metamorphosing of the ore in the sulfide zone, particularly in the limestone zone, it is outside of the realm of supposition. And, the computation has been omitted.

We were told that originally Mr. J. FRomaget ~~[sic]~~, Chief of the Geological Bureau in Hanoi, inspected this mine and estimated conservatively that the amount of ore is 20,000 tons, and that operations were planned with 15,000 tons as the object. But, the authenticity of this report is not known. And, additionally there were said to be 22 tons in transit from the mine to Thai Nguyen and 710 tons in storage at Haiphong.

(8) The Quality of the Ore

Group member Chiba had an assay performed by the government Mining Bureau at the request of Mitsui Bussan, as above:

Fe	49.16%
Mn.	13.70
SiO_2	1.20

And, two specimens of the iron ore dug up in this survey were assayed by the Meguro Laboratory of Mitsui Industrial Chemicals Company:

Fe	Mn	S	P	SiO_2
64.82	0.61	0.24	0.024	0.80
57.75	2.43	0.12	0.021	1.77

In these the iron-content was found by Chiba to be of a comparatively high grade, and the manganese was established to be in a minor amount, as learned previously. (Note that this data was determined by drying the ore at a temperature of 100° to 105° Centigrade.)

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Next, the assay of the remaining pyrite ore is as follows:

Sulfur	43.10%	
Iron	47.79	- a rather good ore

(8) History, Etc.

The village name Nanoi derives from the mountain arising behind the village. The Mab mine is on the mid-flank of this mountain. From several centuries back, we heard, the silver and lead ore here has been worked in this vicinity. Mr. Rasario prospected over 400 hectares of the area in about two months time, cumulative, from 1938 to the first part of 1940, discovering the manganese ore (?) of this concession, of the Bibi concession (Prospecting and Mining Concession No. 995) and of the Kennat concession Prospecting and Mining concession No. 989). And, from May of last year small-scale mining was begun. From July of that year more serious mining eas started, but because of a shortage of funds they have borrowed from Mr. Shimomura, superintendent of the firm, and from others.

Now, as the Taihei Mining Company is guaranteeing Mr. Rasario's concessions, an agreement was reached on December 5 this year which is said to have provided that the superintendent of the firm, Mr. Shimomura (Mr. Riju Shimomura) would be responsible for financial assistance and the Taihei Mining Company, for shipping this manganese ore (?) to Japan, as well as for guidance and supervision of the development. Consequently, Taihei Mining has also agreed to pay 79% of the price of the ore in French Indo-China, based on the assay results, and then to pay the balance after the ore reaches Japan.

(9) Mining

Under present operating conditions three tons of earth are being excavated for each single ton of ore taken from the so-called "gradan" (terrace). From the very bottom, at an elevation of 400 meters, to the top, at about 500 meters, there are four or five terraces. Both loose-rock and outcropping ore are being mined. At the scene of the digging there are two pits (in the process of being dug): one is 7 meters and the other, 12 meters. Both are being sunk to the ore rock, but have not yet passed the limestone.

(10) Ore Sorting

For the most part, the sorting is done by hand, using hammers. (Many of the sorters are women.) In the future, it is said, it has been arranged to use a crushing machine powered by a 25 h.p. generator.

In mining the iron ore, or manganese ore, the admixture of the above-noted iron pyrite ore must receive special attention.

(11) Shipping

There is a bus route on the auto highway from Hanoi to Nanoi where the mine office is; this connects Hanoi with Ngan Son. Leaving Hanoi at six in the morning, one arrives at about 5 PM. By cab, only four to four and a half hours are required. From here [mine office?] to the mine is about 2,000 meters up a rather steep grade. The ore is hauled from the mine to the storage depot by oxcart, and is raised by a single powered steel cableway to the roadside depot. From there it is hauled by a kind of covered horse wagon called a Charrctt [sic] to Phu-Ton, a distance of 25 kilometers. Each cart can haul 0.5 tons one way in a day, so that for each to haul a ton four days are required.

At Phu-Ton there is a storage depot at the road fork near to the village and another in the village. Both sites together have a capacity of 300 tons. We were told that at present the horse-cart fee is 13 piasters per ton.

Next, the 105 kilometers from Phu-Ton to Thai Nguyen is covered by truck. The shipping cost is 5 piasters per ton (Thus, 18 piasters per ton from Na-Noi to Phu-Ton [sic]).

And, the 200 kilometers from Thai Nguyen to Haiphong is covered by "junk". But, for about one month, from November 20th, the canal between Thai Nguyen and Phu Lang Thuong is being cleaned and the lock gates are blocked, so that during that period trucks do the hauling from Phu-Ton or Na-Noi to Da-Phue, and from there junks are dispatched to Haiphong, we were told.

(12) Conclusions

The so-called manganese ore deposit at the Mab mine is said to have been developed by the associated persons with the large amount of manganese first assayed as the object. But, Mr. Fromaget, Hanoi Mining Bureau chief, is said to have considered it to be manganese ore and to have totalled the amount of ore. But, it is difficult to know whether this is true or not. Anyone with any experience with mines ore ores who sees the distinctive striations in the loose rock or the outcropping at the mine would never be able to take it for manganese ore. But, the developers simply are so eager to go ahead with the development that they are proceeding anyway. They will make our compatriots the victims of their efforts and will surely become the laughing stock of the foreigners and native people alike. This certainly leaves the impression of scant experience with mining. By luck, our present survey provides the inducement for reflection on this mine and will cause them to think about ceasing operations. This lessening of their loss will be the lesser of two evils, and thus will not be simply a negative contribution.

Then, this ore is limonite ore containing some manganese; and it originated from iron pyrite ore (iron sulfide ore) that was deeply weathered and that was secondarily converted into iron (limonite) ore. (This is an important item of discovery in this survey.) Consequently, the boundary between the limonite ore and the iron pyrite ore, because of the high water level in the soil and the abundant tropical rain in the mountains, is quite irregular. And, to compute the amount of ore is not possible under existing conditions. The transitional parts make any distinction between the two difficult.

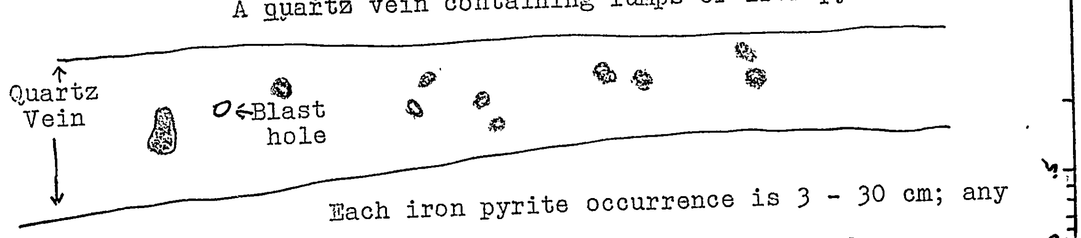
Section 3. The Quartz Vein Containing Iron Sulfide in the Nic Concession

(1) Concession and Location

(Illustration)

Nic Concession (Rasario) seen from north end.

A quartz vein containing lumps of iron pyrite ore.



Each iron pyrite occurrence is 3 - 30 cm; any smaller than than are not indicated.

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This is a concession under application by Rasario and is located at the north end of the Nic concession. From Ngan Son it is about 2 kilometers by mountain road. The distance between Hanoi and Ngan Son is about 221 kilometers. For the history, see the above.

(2) Geology and the Ore Deposit

This is an area consisting of the same Silurian-Devonian limestone and clay-slate [as the other areas[. The veins of quartzite are in the clay-lsate. There are two or three/of these rock masses of about one meter in thickness on top of the mountain some 60 meters apart. The quartz veins to the naked eye have a scattering of good-quality iron sulfide spots, but there is not enough ore here to be considered important.

For purposes of comparison, we had an assay made of the median sample of this quartz vein by the Meguro Laboratory of the Mitsui Mining Company, resulting in the following:

Gold	0.00002
Silver	0.0021

Thus, it is not hopeful as gold or silver ore.

Section 4. Conclusions

Of the various concessions surveyed, the Mab manganese ore concession actually contained iron ore which had been mistaken for manganese ore. And, this survey gives the persons concerned an incentive to escape further useless expenditures. While this is a negative effect, the inspection tour of our survey team did not end in profitlessness, as has been carefully noted here.